Public Buildings Enhanced Energy Efficiency Program

Investigation Results For
Minnesota State University Moorhead

6/15/2012

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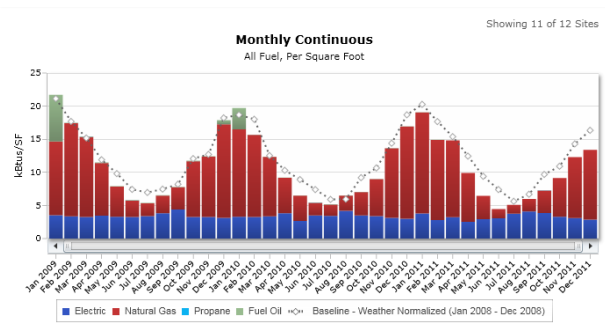
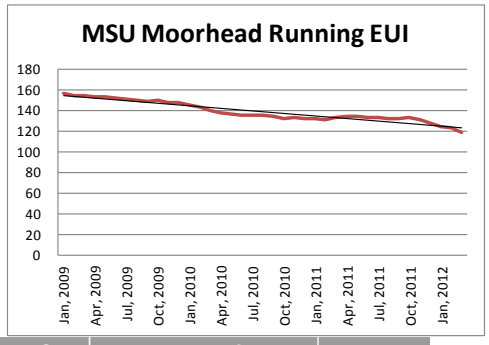
PBEEEP State Government

Investigation Overview

The goal of a PBEEEP Energy Investigation is to identify energy savings opportunities with a payback of fifteen years or less. Particular emphasis is on finding those opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. During the investigation phase the provider conducts a rigorous analysis of the building operations. Through observation, targeted functional testing, and analysis of extensive trend and portable logger data, the RCx Provider identifies deficiencies in the operation of the mechanical equipment, lighting, envelope, and related controls. The investigation of the Minnesota State University Moorhead was performed by Sebesta Blomberg & Associates, Inc. This report is the result of that information.

Payback Information and Energy Savings				
Total Project costs (Without Co-funding)			**Project costs with Co-funding**	
Total costs to date including study	$158,824		Total Project Cost	$209,785
Future costs including Implementation , Measurement & Verification	$50,961		Study and Administrative Cost Paid with ARRA Funds	($161,824)
Total Project Cost	$209,785		Utility Co-funding	($21,425)
			Total costs after co-funding	$26,536
Estimated Annual Total Savings ($)	$33,575		Estimated Annual Total Savings ($)	$33,575
Total Project Payback (years)	6.2		Total Project Payback (years) with co-funding	0.8
Electric Energy Savings	**4.2 %**	**and**	**Natural Gas Savings**	**7.3 %**
(Savings percentages are based on buildings in this project which are 42% of the Main Campus)				





Year	Days	SF	Total kBtu	Normalized Baseline kBtu	Change from Baseline kBtu	% Change	Total Energy Cost $	Average Cost Rate $ /kBtu
2009	365	1,757,157	248,946,181	261,508,215	-12,562,034	-5%	$2,433,060.04	$0.01
2010	365	1,757,157	223,731,087	247,195,286	-23,464,200	-9%	$2,197,778.18	$0.01
2011	365	1,757,157	215,779,228	256,867,337	-41,088,109	-16%	$2,172,292.65	$0.01

MN State University Moorhead energy consumption decreased 15% during the period of the Investigation

Summary Tables

Facility Name	Minnesota State University Moorhead
Location	1104 7th Ave S Moorhead, MN 56563
Facility Manager	Jeff Goebel, Physical Plant Director
Number of Buildings Investigated	14
Interior Square Footage Investigated	697,449 investigated of 1,665,814
PBEEEP Provider	Sebesta, Blomberg, Inc.
Site Project Manager	Jeff Goebel
Annual Energy Cost	$2,258,207 (from 2009 utility data)
Utility Company	Moorhead Public Service (electricity) Xcel Energy (natural gas)
Site Energy Use Index (EUI)	141 kBtu/sq. ft (at start of study from B3) 119 kBtu/sq. ft (at end of study from B3)
Benchmark EUI (from B3)	128 kBtu/sq. ft

Buildings Investigated:

The thirteen buildings listed below totaling 697,449 interior square feet at MSU Moorhead were investigated.

Building Name	State ID	Area (Square Feet)	Year Built
Bridges Hall	E26072S1367	50,880	1967
Center for Business	E26072S1995	37,925	1995
Grier Hall	E26072S0232	7,028	1930
Holmquist Hall	E26072S5869	44,784	1965
King Hall	E26072S1470	40,874	1970
Maint. Bldg./Physical Plant	E26072S1966	21,700	1966
Murray Commons	E26072S5970	34,100	1970
Wellness Center	E26072S8505	43,019	2008
Center for the Arts	E267072S1266/E2672S1779	130,464	1999
Hagen Hall	E26072S1063	92,435	1962
Science Laboratory	E26072S3504	87,000	2004
Heating Plant	E26072S0759	13,833	1959
MacLean Hall	E26072S0632	93,407	1932

None of the buildings are sub-metered or metered individually.

Mechanical Equipment Summary Table	
42	AHU
165	VAV
8	Chillers
17	Steam/HW Converters
13	CHW Pumps
30	HW Pumps
2	CDW Pump
15	EF
150	FCU
1	DX
4	Boiler-Steam
1	Boiler-Electric
43	Window A/C
3	PRV
12	Other Pumps

Implementation Information			
Estimated Annual Total Savings ($)			$33,575
Total Estimated Implementation Cost ($)			$47,961
GHG Avoided in U.S Tons (CO2e)			534
Electric Energy Savings (kWh) (2011 Usage 8,491,079 kWh)*	4.2 % Savings		359,633
Electric Demand Savings (Peak kW)			0
Natural Gas Savings (Therms) (2010 Usage 615,833Therms)*	7.3 % Savings		45,162
Statistics			
Number of Measures identified			41
Number of Measures with payback < 3 years			19
Screening Start Date	02/25/2010	Screening End Date	04/25/2010
Investigation Start Date	08/04/2011	Investigation End Date	4/30/2012
Final Report	6/15/2012	Report Presentation	

*Prorated based on building area which is 42% of total campus

Minnesota State University Moorhead Cost Information			
Phase		**To date**	**Estimated**
Screening		$10,106	
Investigation [Provider]		$132,710	
Investigation [CEE]		$16,008	$1,000
Implementation			$47,961
Implementation [CEE]			$1,000
Measurement & Verification			$1,000
Total		$158,824	$50,961

Co-funding Summary	
Study and Administrative Cost	$161,824
Utility Co-funding ($)	$21,425
Total Co-funding ($)	$79,239

MSU Moorhead Overview

The energy investigation of thirteen buildings that make up 42 % of the building area at Minnesota State University Moorhead identified 6.3 % of energy savings in these buildings with measures that payback in less than 15 years and do not adversely affect occupant comfort. The energy savings opportunities identified at Minnesota State University Moorhead include adjusting air handler schedules, repairing failed condensate traps, adjusting controls to reduce overheating and over cooling of some spaces, adjusting economizers, and adjusting valves that are throttled. The total cost of implementing all the measures is $47,961.

Implementing all these measures can save the facility approximately $33,575 a year, paying back the cost of implementation by energy savings in 1.4 years. Because the study was paid for with ARRA funds the payback is based only on the implementation costs (the study cost is excluded). After an Xcel Energy study rebate the payback is reduced to less than 10 months.

During the period of the PBEEEP investigation energy use at Minnesota State University decreased by about 15% compared to the year prior to the study. This is the largest improvement seen at any site that is in the program. Implementing the measures identified here will help MSU Moorhead meet the Governor's Better Buildings Challenge of a 20% overall energy use reduction when compared with their baseline period. It is now 6% below the benchmark value according to the Minnesota Benchmarking and Beyond database (B3).

MSU Moorhead is comprised of 40 buildings totaling 1,725,190 interior square feet. There are seven dormitory buildings, fourteen office and/or classroom buildings, a healthcare facility, a multifamily housing building, a field house, a student union, a mechanical building, a library and computing center, a maintenance shop, a laboratory, a dining facility, a storage building, and an exercise facility. All of the buildings are located on campus except for the Regional Science Center, which is in Glydon, Minnesota.

The Heating Plant has four steam boilers that serve the entire campus, except for the Campus Security Building, the Foundation Annex, the Hendrix Health Center, John Neumaier Hall, and the Regional Science Center. Those buildings have their own boilers, forced air furnaces, or rooftop units that provide heating. Boilers #1-3 at the steam plant operate during the heating season and provide high-pressure steam at 65 to 85 psi. Boiler #4 operates from mid-May to Labor Day and provides low-pressure steam at around 12 psi. The steam from the Heating Plant is routed to the different buildings in underground tunnels and runs through heat exchangers located in each building. The heat exchangers transfer heat from the steam to water or glycol that is pumped to the air handlers, fin tube radiation and/or reheats in each building. There is not a central chilled water plant. There are thirteen chillers and three cooling towers located in individual buildings on the campus that serve eighteen buildings. Three buildings are cooled with window air conditioners, three buildings have residential forced air furnaces with "central air", four buildings have DX cooling, and two buildings have a combination of DX cooling and chilled water. Five buildings are not cooled. There are seven small houses on campus, each less than 5,000 square feet, for which the heating and cooling systems are unknown.

Twenty-four of the buildings on campus are controlled by a Honeywell EBI R310.1 building automation system (BAS). Three of the buildings are controlled by a Johnson Controls Metasys BAS. There are thirteen buildings that are not controlled by either BAS: the Campus Security Building, the Foundation Annex, the Hendrix Health Center, John Neumaier Hall, Lommen Hall, the Regional Science Center, and seven small houses. Many of the buildings have pneumatic actuation and control; the building staff is in the process of switching some to direct digital control (DDC). Bridges Hall and King Hall are the most recent buildings to be switched to DDC and the Center for Business is in the process. Murray Commons and Weld Hall are buildings that still have a significant amount of pneumatic actuation and control.

There are ten electric meters, seventeen natural gas meters, and one fuel oil meter for all the buildings located on campus. The main campus is served by seven natural gas meters, and one electric meter. The other meters are attached to the following buildings that are individually metered on campus: the Foundation Annex, John Neumaier Hall, and seven small houses. The Regional Science Center has four electric meters and one propane meter.

The buildings were all constructed between 1905 and 2008. There have been major renovations to the mechanical systems in some of the buildings since they were constructed There have been major space use changes within the buildings as well.

Findings Summary

Site: MSU Moorhead Part 2

Eco #	Building	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
4	MacLean Hall	AHU-2 is excessively scheduled	$620	$4,636	0.13	$0	0.13	88
8	Center for the Arts	AAHU-2 runs excessively.	$810	$3,281	0.25	$0	0.25	68
7	Center for the Arts	AAHU-1 runs excessively.	$1,150	$3,615	0.32	$0	0.32	77
2	Holmquist Hall	Failed condensate trap	$538	$1,290	0.42	$0	0.42	15
3	Holmquist Hall	Failed condensate trap	$538	$1,290	0.42	$0	0.42	15
11	Center for the Arts	AAHU-2 is overcooling and overheating the space.	$1,150	$2,587	0.44	$0	0.44	8
1	Murray Commons	Failed end of main condensate trap	$580	$1,290	0.45	$0	0.45	15
19	Center for the Arts	AAHU-2 is over ventilating the space	$1,425	$1,737	0.82	$0	0.82	23
12	Bridges Hall	Measures 10 and 11 combined (by PBEEEP)	$923	$1,075	0.86	$0	0.86	14
18	Center for the Arts	AC-2 is running excessively.	$921	$998	0.92	$0	0.92	17
13	Holmquist Hall	AHU-2 is excessively heating the space.	$428	$404	1.06	$0	1.06	5
11	Holmquist Hall	AHU-1 is excessively heating the space.	$428	$396	1.08	$0	1.08	4
23	Center for the Arts	S-4 is operating for too many hours.	$1,040	$890	1.17	$0	1.17	13
8	Wellness Center	AHU 2 overheating and over cooling the space.	$690	$509	1.35	$0	1.35	10
9	Center for the Arts	AAHU-1 is over ventilating the space	$1,381	$1,015	1.36	$0	1.36	12
16	Center for the Arts	AHU-S7 excessive run time	$2,990	$2,097	1.43	$0	1.43	42
3	King Hall	AC-1 Cold deck reset schedule	$1,270	$607	2.09	$0	2.09	13
10	Center for the Arts	AAHU-1 is overcooling the space and over heating the space.	$1,150	$498	2.31	$0	2.31	10
2	King Hall	AC-1 enthalpy and economizer control.	$7,020	$2,521	2.79	$0	2.79	33
5	Wellness Center	AHU1 overheating and overcooling the space	$580	$193	3.01	$0	3.01	5

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Summary

Site: MSU Moorhead Part 2

Eco #	Building	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
4	Wellness Center	Optimize AHU1 economizer	$920	$295	3.12	$0	3.12	8
24	Center for the Arts	S-4 is over cooling and over heating the space	$810	$166	4.89	$0	4.89	3
7	Wellness Center	AHU 2 return fan overpressurizing and economizer	$1,150	$225	5.12	$0	5.12	5
2	Wellness Center	VAV-28: Room 100 room temperature does not meet setpoint	$1,960	$346	5.66	$0	5.66	4
13	Center for the Arts	AAHU-3 is over cooling and over heating the space.	$1,150	$184	6.24	$0	6.24	3
7	Murray Commons	AC-3 is over cooling and overheating the space	$920	$131	7.04	$0	7.04	2
4	Murray Commons	AC-1 is over cooling the space and over heating the space.	$810	$103	7.85	$0	7.85	2
2	Grier Hall	Not Occupied	$810	$92	8.77	$0	8.77	1
14	Center for the Arts	AC-2 is over heating and over cooling the spaces	$1,840	$183	10.07	$0	10.07	3
4	Bridges Hall	Uninsulated 4" steam valve	$505	$47	10.81	$0	10.81	1
4	Holmquist Hall	HWP-3 is throttled.	$768	$69	11.05	$0	11.05	2
5	Holmquist Hall	HWP-4 is throttled.	$768	$69	11.05	$0	11.05	2
4	Grier Hall	Economizer Minimum Outdoor Air	$690	$59	11.79	$0	11.79	1
17	Center for the Arts	EF-30 excessive run time	$280	$24	11.85	$0	11.85	1
1	Heating Plant	Split system temperature is to high	$38	$3	12.16	$0	12.16	0
6	Hagen Hall	HW Pumps 1-4 run continuously year round.	$920	$75	12.20	$0	12.20	2
1	Maintenance Building	S2 leaking steam valve.	$460	$36	12.82	$0	12.82	0
3	Wellness Center	VAV-23: Room 122 room temperature does not meet setpoint	$1,960	$150	13.10	$0	13.10	2
15	Center for the Arts	AC-3 is over cooling and over heating the spaces.	$4,141	$292	14.17	$0	14.17	6

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Findings Summary

Site: MSU Moorhead Part 2

Eco #	Building	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
2	Center for Business	HWP-1 discharge is throttled	$810	$56	14.37	$0	14.37	2
2	MacLean Hall	AHU-1 Running overnight	$620	$41	15.28	$0	15.28	1
		Total for Findings with Payback 3 years or less:	**$25,051**	**$30,737**	**0.82**	**$0**	**0.82**	**481**
		Total for all Findings:	**$47,961**	**$33,575**	**1.43**	**$0**	**1.43**	**534**

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MSU Moorhead-Phase 2

Finding Type Number	Finding Type	Relevant Findings	Looked for, not found	Not relevant
a.1 (1)	Time of Day enabling is excessive	4	8	
a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	2	7	1
a.3 (3)	Lighting is on more hours than necessary.		10	2
a.4 (4)	OTHER_Equipment Scheduling/Enabling		7	4
b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer	2	10	
b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design	3	8	1
b.3 (7)	OTHER_Economizer/OA Loads	1	6	4
c.1 (8)	Simultaneous Heating and Cooling is present and excessive	2	6	2
c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	2	8	
c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	6	5	
c.4 (11)	OTHER_Controls	3	1	5
d.1 (12)	Daylighting controls or occupancy sensors need optimization.		4	7
d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	8	2	
d.3 (14)	Fan Speed Doesn't Vary Sufficiently		5	5
d.4 (15)	Pump Speed Doesn't Vary Sufficiently	1	4	7
d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary		4	7
d.6 (17)	Other_Controls (Setpoint Changes)		5	5
e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal		8	3
e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal	2	5	5
e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal	2	5	4
e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal		6	5

e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal		1	11
e.6 (22)	Other_Controls (Reset Schedules)		3	8
f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit		3	8
f.2 (24)	Pump Discharge Throttled	4	5	3
f.3 (25)	Over-Pumping	1	7	1
f.4 (26)	Equipment is oversized for load.	1	10	
f.5 (27)	OTHER_Equipment Efficiency/Load Reduction		4	6
g.1 (28)	VFD Retrofit - Fans	2	7	3
g.2 (29)	VFD Retrofit - Pumps		5	5
g.3 (30)	VFD Retrofit - Motors (process)			12
g.4 (31)	OTHER_VFD		1	11
h.1 (32)	Retrofit - Motors		9	1
h.2 (33)	Retrofit - Chillers		6	6
h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)		2	10
h.4 (35)	Retrofit - Boilers		1	10
h.5 (36)	Retrofit - Packaged Gas fired heating		1	11
h.6 (37)	Retrofit - Heat Pumps			12
h.7 (38)	Retrofit - Equipment (custom)			12
h.8 (39)	Retrofit - Pumping distribution method		6	6
h.9 (40)	Retrofit - Energy/Heat Recovery		1	10
h.10 (41)	Retrofit - System (custom)		1	11
h.11 (42)	Retrofit - Efficient Lighting		4	8
h.12 (43)	Retrofit - Building Envelope		5	7
h.13 (44)	Retrofit - Alternative Energy		2	9
h.14 (45)	OTHER_Retrofit	1	2	9
i.1 (46)	Differed Maintenance from Recommended/Standard		5	2

i.2 (47)	Impurity/Contamination		9	1
i.3 ( )	Leaky/Stuck Damper		7	1
i.4 ( )	Leaky/Stuck Valve	1	7	1
i.5 (48)	OTHER_Maintenance		6	3
j.1 (49)	OTHER	4	1	3

Findings Glossary: Findings Examples

a.1 (1)	**Time of Day enabling is excessive**
	• HVAC running when building is unoccupied. Equipment schedule doesn't follow building occupancy • Optimum start-stop is not implemented • Controls in hand
a.2 (2)	**Equipment is enabled regardless of need, or such enabling is excessive**
	• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating
a.3 (3)	**Lighting is on more hours than necessary**
	• Lighting is on at night when the building is unoccupied • Photocells could be used to control exterior lighting • Lighting controls not calibrated/adjusted properly
a.4 (4)	**OTHER Equipment Scheduling and Enabling**
	• Please contact PBEEEP Project Engineer for approval
b.1 (5)	**Economizer Operation – Inadequate Free Cooling**
	• Economizer is locked out whenever mechanical cooling is enabled (non-integrated economizer) • Economizer linkage is broken • Economizer setpoints could be optimized • Plywood used as the outdoor air control • Damper failed in minimum or closed position
b.2 (6)	**Over-Ventilation**
	• Demand-based ventilation control has been disabled • Outside air damper failed in an open position • Minimum outside air fraction not set to design specifications or occupancy
b.3 (7)	**OTHER Economizer/Outside Air Loads**
	• Please contact PBEEEP Project Engineer for approval
c.1 (8)	**Simultaneous Heating and Cooling is present and excessive**
	• For a given zone, CHW and HW systems are unnecessarily on and running simultaneously • Different setpoints are used for two systems serving a common zone
c.2 (9)	**Sensor / Thermostat needs calibration, relocation / shielding, and/or replacement**
	• OAT temperature is reading 5 degrees high, resulting in loss of useful economizer operation • Zone sensors need to be relocated after tenant improvements • OAT sensor reads high in sunlight
c.3 (10)	**Controls "hunt" / need Loop Tuning or separation of heating/cooling setpoints**
	• CHW valve cycles open and closed • System needs loop tuning – it is cycling between heating and cooling
c.4 (11)	**OTHER Controls**
	• Please contact PBEEEP Project Engineer for approval
d.1 (12)	**Daylighting controls or occupancy sensors need optimization**
	• Existing controls are not functioning or overridden • Light sensors improperly placed or out of calibration
d.2 (13)	**Zone setpoint setup / setback are not implemented or are sub-optimal**
	• The cooling setpoint is 74 ºF 24 hours per day
d.3 (14)	**Fan Speed Doesn't Vary Sufficiently**
	• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating

d.4 (15)	**Pump Speed Doesn't Vary Sufficiently**
	• Pump runs at 15 PSI on peak day. Lowering pressure to 12 does not create comfort problem and the flow is per design. Low ΔT across the chiller during low load conditions.
d.5 (16)	**VAV Box Minimum Flow Setpoint is higher than necessary**
	• Boxes universally set at 40%, regardless of occupancy. Most boxes can have setpoints lowered and still meet minimum airflow requirements.
d.6 (17)	**Other Controls (Setpoint Changes)**
	• Please contact PBEEEP Project Engineer for approval
e.1 (18)	**HW Supply Temperature Reset is not implemented or is sub-optimal**
	• HW supply temperature is a constant 180 ºF. It should be reset based on demand, or decreased by a reset schedule as OAT increases. • DHW Setpoints are constant 24 hours per day
e.2 (19)	**CHW Supply Temperature Reset is not implemented or is sub-optimal**
	• CHW supply temperature is a constant 42 ºF. It could be reset, based on demand or ambient temperature.
e.3 (20)	**Supply Air Temperature Reset is not implemented or is sub-optimal**
	• The SAT is constant at 55 ºF. It could be reset to minimize reheat and maximize economizer cooling. The reset should ideally be based on demand (e.g., looking at zone box damper positions), but could also be reset based on OAT.
e.4 ( )	**Supply Duct Static Pressure Reset is not implemented or is suboptimal**
	• The Duct Static Pressure (DSP) is constant at 1.5" wc. It could be reset to minimize fan energy. The reset should ideally be based on demand (e.g. looking at zone box damper positions), but could also be reset based on OAT.
e.5 (21)	**Condenser Water Temperature Reset is not implemented or is sub-optimal**
	• CW temperature is constant leaving the tower at 85 ºF. The temperature should be reduced to minimize the total energy use of the chiller and tower. It may be worthwhile to reset based on load and ambient conditions.
e.6 (22)	**Other Controls (Reset Schedules)**
	• Please contact PBEEEP Project Engineer for approval
f.1 (23)	**Lighting system needs optimization - Spaces are overlit**
	• Lighting exceeds ASHRAE or IES standard levels for specific space types or tasks
f.2 (24)	**Pump Discharge Throttled**
	• The discharge valve for the CHW pump is 30% open. The valve should be opened and the impeller size reduced to provide the proper flow without throttling.
f.3 (25)	**Over-Pumping**
	• Only one CHW pump runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
f.4 (26)	**Equipment is oversized for load**
	• The equipment cycles unnecessarily • The peak load is much less than the installed equipment capacity

f.5 (27)	**OTHER Equipment Efficiency/Load Reduction**
	• Please contact PBEEEP Project Engineer for approval
g.1 (28)	**VFD Retrofit Fans**
	• Fan serves variable flow system, but does not have a VFD. • VFD is in override mode, and was found to be not modulating.
g.2 (29)	**VFD Retrofit - Pumps**
	• 3-way valves are used to maintain constant flow during low load periods. • Only one CHW pumps runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
g.3 (30)	**VFD Retrofit - Motors (process)**
	• Motor is constant speed and uses a variable pitch sheave to obtain speed control.
g.4 (31)	**OTHER VFD**
	• Please contact PBEEEP Project Engineer for approval
h.1 (32)	**Retrofit - Motors**
	• Efficiency of installed motor is much lower than efficiency of currently available motors
h.2 (33)	**Retrofit - Chillers**
	• Efficiency of installed chiller is much lower than efficiency of currently available chillers
h.3 (34)	**Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)**
	• Efficiency of installed air conditioner is much lower than efficiency of currently available air conditioners
h.4 (35)	**Retrofit - Boilers**
	• Efficiency of installed boiler is much lower than efficiency of currently available boilers
h.5 (36)	**Retrofit - Packaged Gas-fired heating**
	• Efficiency of installed heaters is much lower than efficiency of currently available heaters
h.6 (37)	**Retrofit - Heat Pumps**
	• Efficiency of installed heat pump is much lower than efficiency of currently available heat pumps
h.7 (38)	**Retrofit - Equipment (custom)**
	• Efficiency of installed equipment is much lower than efficiency of currently available equipment
h.8 (39)	**Retrofit - Pumping distribution method**
	• Current pumping distribution system is inefficient, and could be optimized. • Pump distribution loop can be converted from primary to primary-secondary)
h.9 (40)	**Retrofit - Energy / Heat Recovery**
	• Energy is not recouped from the exhaust air. • Identification of equipment with higher effectiveness than the current equipment.
h.10 (41)	**Retrofit - System (custom)**
	• Efficiency of installed system is much lower than efficiency of another type of system
h.11 (42)	**Retrofit - Efficient lighting**
	• Efficiency of installed lamps, ballasts or fixtures are much lower than efficiency of currently available lamps, ballasts or fixtures.

h.12 (43)	**Retrofit - Building Envelope**
	• Insulation is missing or insufficient • Window glazing is inadequate • Too much air leakage into / out of the building • Mechanical systems operate during unoccupied periods in extreme weather
h.13 (44)	**Retrofit - Alternative Energy**
	• Alternative energy strategies, such as passive/active solar, wind, ground sheltered construction or other alternative, can be incorporated into the building design
h.14 (45)	**OTHER Retrofit**
	• Please contact PBEEEP Project Engineer for approval
i.1 (46)	**Differed Maintenance from Recommended/Standard**
	• Differed maintenance that results in sub-optimal energy performance. • Examples: Scale buildup on heat exchanger, broken linkages to control actuator missing equipment components, etc.
i.2 (47)	**Impurity/Contamination**
	• Impurities or contamination of operating fluids that result in sub-optimal performance. Examples include lack of chemical treatment to hot/cold water systems that result in elevated levels of TDS which affect energy efficiency.
i.3 ( )	**Leaky/Stuck Damper**
	• The outside or return air damper on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.4 ( )	**Leaky/Stuck Valve**
	• The heating or cooling coil valve on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.5 (48)	**OTHER Maintenance**
	• Please contact PBEEEP Project Engineer for approval
j.1 (49)	**OTHER**
	• Please contact PBEEEP Project Engineer for approval

Findings Summary

Building: Bridges Hall
Site: MSU Moorhead Part 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
12	Measures 10 and 11 combined (by PBEEEP)	$923	$1,075	0.86	$0	0.86	14
4	Uninsulated 4" steam valve	$505	$47	10.81	$0	10.81	1
	Total for Findings with Payback 3 years or less:	**$923**	**$1,075**	**0.86**	**$0**	**0.86**	**14**
	Total for all Findings:	**$1,428**	**$1,122**	**1.27**	**$0**	**1.27**	**15**

Findings Details

Building: Bridges Hall

FWB Number:	11551	Eco Number:	4
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	Uninsulated 4" steam valve	Date Identified:	11/1/2011
Description of Finding:	The uninsulated steam valve is 230 degrees. The surrounding insulation is 90 degrees.		
Equipment or System(s):	Boiler Plant	Finding Category:	OTHER
Finding Type:	Other		

Implementer:	Insulation Contractor	Benefits:	Lower gas usage.
Baseline Documentation Method:	The room was warm and you could feel the heat radiating off the valve. I measure the valve temperature and insulated piping temperature with a temperature gun infrared thermometer. The uninsulated steam valve is 230 degrees. The surrounding insulation is 90 degrees.		
Measure:	Insulate the 4" steam valve		
Recommendation for Implementation:	Insulate the 4 inch steam valve.		
Evidence of Implementation Method:	Pictures of the insulated steam valve.		

Annual Natural Gas Savings (therms):	95	Contractor Cost ($):	$350
Estimated Annual Natural Gas Savings ($):	$47	PBEEEP Provider Cost for Implementation Assistance ($):	$155
		Total Estimated Implementation Cost ($):	$505

Estimated Annual Total Savings ($):	$47	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	10.81	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	10.81	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	1	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.1%	Percent of Implementation Costs:	1.1%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

PBEEEP State Government

Building: Bridges Hall

FWB Number:	11551	Eco Number:	12
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	Measures 10 and 11 combined (by PBEEEP)	Date Identified:	1/5/2011
Description of Finding:	The cold deck temperature is a constant 55 degrees over the course of the year. The heating pumps are on adding additional heat to the system and the cooling is also active. The discharge cold deck is 55 and the hot deck is 80-85 degrees when the OAT is above 70 degrees. The energy savings does not include the energy saving of not running the pump. The pump only turns on when the AHU is operating.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls Problems
Finding Type:	Other Controls		

Implementer:	Controls contractor.	Benefits:	Lower electrical consumption. Lower gas consumption.
Baseline Documentation Method:	Trending and the averageif statement show the discharge air temps on cold temperature does not modulate much. The cold deck temperature is a constant 55-57 degrees. Trending shows that the heating water pumps are on when the OAT is above 70 degrees. The discharge air temperature on the hot deck side is 80 to 85 degrees when the OAT is above 70 degrees. The return air temperature during this period is around 75 degrees and the mixed air temperature is around 80 degrees.		
Measure:	Reprogram the AHU to reset the discharge based on OAT. Turn off the heating pumps and lock out the steam valves when the OAT is above 70 degrees.		
Recommendation for Implementation:	Reprogram the AHU to reset the discharge based on OAT. When the OAT is 0 the discharge air shall be 65 and when the OAT is 95 the discharge air shall be 55. The mixed air damper shall modulate the discharge air temperature on the cold deck when the OAT is below 55 degrees. This will reduce the amount of OA. Reprogram the pumps that only serve AHU 1 and AHU 2 to be turned off when the OAT is above 70 degrees.		
Evidence of Implementation Method:	Trend the Oat, MAT, and Cold Deck temp. Trending should be done for a month between summer and shoulder season when the OAT is above 75 and below 40 degrees. Trending should be done on 15 minute intervals. Trend the HWP-1 and HWP-2 when the OAT is between 60 and 80 degrees outside for a period of two weeks at 15 minute intervals.		

Annual Electric Savings (kWh):	4,539	Peak Demand Savings (kWh):	1
Estimated Annual kWh Savings ($):	$144	Estimated Annual Demand Savings ($):	$16
Annual Natural Gas Savings (therms):	1,866	Contractor Cost ($):	$690
Estimated Annual Natural Gas Savings ($):	$916	PBEEEP Provider Cost for Implementation Assistance ($):	$233
		Total Estimated Implementation Cost ($):	$923

Estimated Annual Total Savings ($):	$1,075	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.86	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.86	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	14	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	3.2%	Percent of Implementation Costs:	1.9%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Summary

Building: Center for Business
Site: MSU Moorhead Part 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
2	HWP-1 discharge is throttled	$810	$56	14.37	$0	14.37	2
	Total for Findings with Payback 3 years or less:	**$0**	**$0**	**0.00**	**$0**	**0.00**	**0**
	Total for all Findings:	**$810**	**$56**	**14.37**	**$0**	**14.37**	**2**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Center for Business

FWB Number:	11552	Eco Number:	2
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	HWP-1 discharge is throttled	Date Identified:	11/1/2011
Description of Finding:	The triple duty valve is 75 percent open.		
Equipment or System(s):	Pump, HW distribution	Finding Category:	Equipment Efficiency Improvements / Load Reduction
Finding Type:	Pump Discharge Throttled		

Implementer:	Mechanical Contractor	Benefits:	Lower electrical consumption.
Baseline Documentation Method:	Visual and photographed. The pump runs for 2500 hours a year. There are approximately 5000 run hours for the heating system at this building and this is a lead/lag pump and only runs 50% of the time.		
Measure:	Trim the impeller.		
Recommendation for Implementation:	Remove the impeller in the pump casing. Send the impeller to the manufacturer for trimming. The pump seals would also have to be replaced since the pump has been disassembled for the removal of the impeller. The impeller and new seals would need to be installed and checked for leaking prior to pump being put back into service.		
Evidence of Implementation Method:	Pictures of the before and after impeller size and them installed in the pump casing. Flow tests could be preformed on the pump as well, but seems excessive for such a simple implementation. Invoices from the manufacture of the trimming cost should also be provided.		

Annual Electric Savings (kWh):	1,779	Contractor Cost ($):	$655
Estimated Annual kWh Savings ($):	$56	PBEEEP Provider Cost for Implementation Assistance ($):	$155
		Total Estimated Implementation Cost ($):	$810

Estimated Annual Total Savings ($):	$56	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	14.37	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	14.37	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	2	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.2%	Percent of Implementation Costs:	1.7%

Findings Summary

Building: Grier Hall
Site: MSU Moorhead Part 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
2	Not Occupied	$810	$92	8.77	$0	8.77	1
4	Economizer Minimum Outdoor Air	$690	$59	11.79	$0	11.79	1
	Total for Findings with Payback 3 years or less:	**$0**	**$0**	**0.00**	**$0**	**0.00**	**0**
	Total for all Findings:	**$1,500**	**$151**	**9.94**	**$0**	**9.94**	**2**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Grier Hall

FWB Number:	11553	Eco Number:	2
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	Not Occupied	Date Identified:	12/12/2011
Description of Finding:	Building is not occupied for the majority of time		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	Controls Contractor
Benefits:	Lower Electrical Consumption. Lower Heating Consumption.
Baseline Documentation Method:	AHU Schedule and onsite interviews. This building is in transition and is rarely being used except for the sound booth. No regular occupancy schedule is used. The doors are normally locked and the AHU is operational.
Measure:	Turn Building off and turn on when needed, possibly have an override to turn on and off for unplanned occupants
Recommendation for Implementation:	Install a new thermostat with an override button. The building will run for an additional 2 hours if the AHU Override button is activated. Program unoccupied setpoints to meet MN State requirements. Manual override to bring building to occupied setpoints for 2 hour period.
Evidence of Implementation Method:	Document new unoccupied and occupied AHU setpoints. Trend the motor status, RAT, MAT, DAT, Clg Vlv, Htg Vlv, MA Damper, and OA FB Damper during unoccupied and occupied times including through full activation/deactivation cycle of manual override.

Annual Electric Savings (kWh):	667	Annual Natural Gas Savings (therms):	145
Estimated Annual kWh Savings ($):	$21	Estimated Annual Natural Gas Savings ($):	$71
Contractor Cost ($):	$655		
PBEEEP Provider Cost for Implementation Assistance ($):	$155		
Total Estimated Implementation Cost ($):	$810		

Estimated Annual Total Savings ($):	$92	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	8.77	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	8.77	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	1	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.3%	Percent of Implementation Costs:	1.7%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Grier Hall

FWB Number:	11553	Eco Number:	4
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	Economizer Minimum Outdoor Air	Date Identified:	3/12/2012
Description of Finding:	The AHU below 70 degrees modulates to a 55 degree MAT. This is over ventilating the space. The OA above 70 degrees is 0%.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Economizer/Outside Air Loads
Finding Type:	Other Economizer/OA Loads		

Implementer:	Balancing and Controls Contractor.	Benefits:	Lower Electrical Consumption. Lower Heating Consumption.
Baseline Documentation Method:	Trends of the MAT, OAT, and RAT shows that when the OAT is above 70 degrees there is no OA being brought in and when the OAT is below 70 degrees the MA damper modulates to maintain a 55 degrees MAT.		
Measure:	Set a minimum OA percentage.		
Recommendation for Implementation:	Set a minimum position for the OA at 15%. Allow the OA to be opened to 15% above 70 degrees, increasing occupancy comfort. Below 70 degrees allow the economizer to work as needed to maintain DAT but set at a minimum of 15% OA. Prevent potential for simultaneous heating and cooling by having Clg Vlv, Heating Vlv, and MA Damper control to maintain DAT instead of current combined MAT (MA Damper) and DAT (htg vlv and clg vlv) controlled scheme.		
Evidence of Implementation Method:	Trend the RAT, MAT, MA Damper, OAT, DAT, and DAT setpoint for two weeks when the OAT is above 65 degrees for two week at 15 minute intervals and for two weeks when the OAT is below 40 degrees.		

Annual Electric Savings (kWh):	-139	Peak Demand Savings (kWh):	-2
Estimated Annual kWh Savings ($):	$-4	Estimated Annual Demand Savings ($):	$-31
Annual Natural Gas Savings (therms):	191	Contractor Cost ($):	$535
Estimated Annual Natural Gas Savings ($):	$94	PBEEEP Provider Cost for Implementation Assistance ($):	$155
		Total Estimated Implementation Cost ($):	$690

Estimated Annual Total Savings ($):	$59	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	11.79	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	11.79	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	1	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.2%	Percent of Implementation Costs:	1.4%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Summary

Building: Holmquist Hall
Site: MSU Moorhead Part 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
2	Failed condensate trap	$538	$1,290	0.42	$0	0.42	15
3	Failed condensate trap	$538	$1,290	0.42	$0	0.42	15
13	AHU-2 is excessively heating the space.	$428	$404	1.06	$0	1.06	5
11	AHU-1 is excessively heating the space.	$428	$396	1.08	$0	1.08	4
4	HWP-3 is throttled.	$768	$69	11.05	$0	11.05	2
5	HWP-4 is throttled.	$768	$69	11.05	$0	11.05	2
	Total for Findings with Payback 3 years or less:	**$1,931**	**$3,381**	**0.57**	**$0**	**0.57**	**38**
	Total for all Findings:	**$3,466**	**$3,519**	**0.98**	**$0**	**0.98**	**42**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Holmquist Hall

FWB Number:	11554	Eco Number:	2
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	Failed condensate trap	Date Identified:	11/2/2011
Description of Finding:	The condensate trap and downstream piping was 200 degrees. The condensate trap is a Mepco model 44-215A with 3/4" NPT with an office size of 0.313. Room E101.		
Equipment or System(s):	Boiler Plant	Finding Category:	OTHER
Finding Type:	Other		

Implementer:	Steam Contractor/ onsite maintenance staff	Benefits:	Reduced steam usage. The room temperature will decrease which will reduce the heat radiated to the first and second floors.
Baseline Documentation Method:	The room was warm and you could feel the heat radiating off the piping. I measured the condensate piping and trap temperature and insulated piping temperature with a temperature gun infrared thermometer. The condensate trap and downstream piping was 200 degrees. The condensate trap is a Mepco model 44-215A with 3/4" NPT with an office size of 0.313. Room E101. This was brought up to the maintenance staff onsite, they were going to do their own investigation.		
Measure:	Replace the condensate trap.		
Recommendation for Implementation:	Replace the steam condensate trap. The condensate trap is a Mepco model 44-215A with 3/4" NPT with an office size of 0.313. This could be done easily by the maintenance staff on campus.		
Evidence of Implementation Method:	Pictures of the new trap installed and provide invoice for work completed.		

Annual Natural Gas Savings (therms):	2,627	Contractor Cost ($):	$460
Estimated Annual Natural Gas Savings ($):	$1,290	PBEEEP Provider Cost for Implementation Assistance ($):	$78
		Total Estimated Implementation Cost ($):	$538

Estimated Annual Total Savings ($):	$1,290	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.42	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.42	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	15	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	3.8%	Percent of Implementation Costs:	1.1%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Holmquist Hall

FWB Number:	11554	Eco Number:	3
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	Failed condensate trap	Date Identified:	11/2/2011
Description of Finding:	The condensate trap and downstream piping was 200 degrees. The condensate trap is a Mepco model 44-215A with 3/4" NPT with an office size of 0.313. Room E102.		
Equipment or System(s):	Boiler Plant	Finding Category:	OTHER
Finding Type:	Other		

Implementer:	Steam Contractor/ onsite maintenance staff	Benefits:	Reduced steam usage. The room temperature will decrease which will reduce the heat radiated to the first and second floors.
Baseline Documentation Method:	The room was warm and you could feel the heat radiating off the piping. I measured the condensate piping and trap temperature and insulated piping temperature with a temperature gun infrared thermometer. The condensate trap and downstream piping was 200 degrees. The condensate trap is a Mepco model 44-215A with 3/4" NPT with an office size of 0.313. Room E102. This was brought up to the maintenance staff onsite, they were going to do their own investigation.		
Measure:	Replace the condensate trap.		
Recommendation for Implementation:	Replace the steam condensate trap. The condensate trap is a Mepco model 44-215A with 3/4" NPT with an office size of 0.313. This could be done easily by the maintenance staff on campus.		
Evidence of Implementation Method:	Pictures of the new trap installed and provide invoice for work completed.		

Annual Natural Gas Savings (therms):	2,627	Contractor Cost ($):	$460
Estimated Annual Natural Gas Savings ($):	$1,290	PBEEEP Provider Cost for Implementation Assistance ($):	$78
		Total Estimated Implementation Cost ($):	$538

Estimated Annual Total Savings ($):	$1,290	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.42	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.42	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	15	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	3.8%	Percent of Implementation Costs:	1.1%

Findings Details

Building: Holmquist Hall

FWB Number:	11554	Eco Number:	4
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	HWP-3 is throttled.	Date Identified:	11/2/2011
Description of Finding:	HWP-3 Discharge butterfly valve is 60 percent open.		
Equipment or System(s):	Pump, HW distribution	Finding Category:	Equipment Efficiency Improvements / Load Reduction
Finding Type:	Pump Discharge Throttled		

Implementer:	Mechanical Contractor/onsite staff	Benefits:	Lower electrical consumption.
Baseline Documentation Method:	The discharge butterfly valve is 60 percent open. Visual and photographed. The pump runs for 2500 hours a year. There is approximately 5000 run hours for the heating system at this building and this is a lead/lag pump and only runs 50% of the time.		
Measure:	Trim the impeller.		
Recommendation for Implementation:	Remove the impeller in the pump casing and the impeller would have to be shipped to the manufacturer for trimming. The pump seals would also have to be replaced since the pump has been disassembled for the removal of the impeller. The impeller and new seals would need to be installed and checked for leaking prior to pump being put back into service.		
Evidence of Implementation Method:	Pictures of the before and after impeller size and them installed in the pump casing. Flow tests could be preformed on the pump as well, but seems excessive for such a simple implementation. Invoices from the manufacture of the trimming cost should also be provided.		

Annual Electric Savings (kWh):	2,191	Contractor Cost ($):	$690
Estimated Annual kWh Savings ($):	$69	PBEEEP Provider Cost for Implementation Assistance ($):	$78
		Total Estimated Implementation Cost ($):	$768

Estimated Annual Total Savings ($):	$69	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	11.05	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	11.05	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	2	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.2%	Percent of Implementation Costs:	1.6%

Findings Details

Building: Holmquist Hall

FWB Number:	11554	Eco Number:	5
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	HWP-4 is throttled.	Date Identified:	11/2/2011
Description of Finding:	HWP-4 Discharge butterfly valve is 60 percent open.		
Equipment or System(s):	Pump, HW distribution	Finding Category:	Equipment Efficiency Improvements / Load Reduction
Finding Type:	Pump Discharge Throttled		

Implementer:	Mechanical Contractor/onsite staff	Benefits:	Lower electrical consumption.
Baseline Documentation Method:	The discharge butterfly valve is 60 percent open. Visual and photographed. The pump runs for 2500 hours a year. There is approximately 5000 run hours for the heating system at this building and this is a lead/lag pump and only runs 50% of the time.		
Measure:	Trim the impeller.		
Recommendation for Implementation:	Remove the impeller in the pump casing and the impeller would have to be shipped to the manufacturer for trimming. The pump seals would also have to be replaced since the pump has been disassembled for the removal of the impeller. The impeller and new seals would need to be installed and checked for leaking prior to pump being put back into service.		
Evidence of Implementation Method:	Pictures of the before and after impeller size and them installed in the pump casing. Flow tests could be preformed on the pump as well, but seems excessive for such a simple implementation. Invoices from the manufacture of the trimming cost should also be provided.		

Annual Electric Savings (kWh):	2,191	Contractor Cost ($):	$690
Estimated Annual kWh Savings ($):	$69	PBEEEP Provider Cost for Implementation Assistance ($):	$78
		Total Estimated Implementation Cost ($):	$768

Estimated Annual Total Savings ($):	$69	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	11.05	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	11.05	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	2	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.2%	Percent of Implementation Costs:	1.6%

Findings Details

Building: Holmquist Hall

FWB Number:	11554	Eco Number:	11
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	AHU-1 is excessively heating the space.	Date Identified:	12/12/2011
Description of Finding:	The room setpoint is 73 degrees. State setpoints during heating season is 68-70 degrees.		
Equipment or System(s):	AHU with heating only	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Zone setpoint setup/setback are not implemented or are sub-optimal		

Implementer:	Controls contractor/onsite staff	Benefits:	Lower gas consumption.
Baseline Documentation Method:	Datalogger trending of the space temperature. Between the November 1 and January 15 the average space temp is 73 degrees. The Ahu is on 24/7 and serves for make up air for the exhaust from the bathrooms.		
Measure:	Adjust the pneumatic thermostat to be 69 degrees.		
Recommendation for Implementation:	Manually adjust the thermostat to be 69 degrees instead of 73 degrees. Install a protective cover so staff can not adjust the room temp.		
Evidence of Implementation Method:	Photograph the thermostat with the changed setpoint and with the new tamper proof cover. Trending with data logger could be done with thermostat, Trending should be set at 15 minute intervals for 2 weeks when the OAT is below 55 degrees.		

Annual Natural Gas Savings (therms):	808	Contractor Cost ($):	$350
Estimated Annual Natural Gas Savings ($):	$396	PBEEEP Provider Cost for Implementation Assistance ($):	$78
		Total Estimated Implementation Cost ($):	$428

Estimated Annual Total Savings ($):	$396	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	1.08	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	1.08	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	4	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	1.2%	Percent of Implementation Costs:	0.9%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Holmquist Hall

FWB Number:	11554	Eco Number:	13
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	AHU-2 is excessively heating the space.	Date Identified:	12/12/2011
Description of Finding:	The room setpoint is 73 degrees. State setpoints during heating season is 68-70 degrees.		
Equipment or System(s):	AHU with heating only	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Zone setpoint setup/setback are not implemented or are sub-optimal		

Implementer:	Controls contractor/onsite staff	Benefits:	Lower gas consumption.
Baseline Documentation Method:	Datalogger trending of the space temperature. Between the November 1 and January 15 the average space temp is 73 degrees. The Ahu is on 24/7 and serves for make up air for the exhaust from the bathrooms.		
Measure:	Adjust the pneumatic thermostat to be 69 degrees.		
Recommendation for Implementation:	Manually adjust the thermostat to be 69 degrees instead of 73 degrees. Install a protective cover so staff can not adjust the room temp.		
Evidence of Implementation Method:	Photograph the thermostat with the changed setpoint and with the new tamper proof cover. Trending with data logger could be done with thermostat, Trending should be set at 15 minute intervals for 2 weeks when the OAT is below 55 degrees.		

Annual Natural Gas Savings (therms):	823	Contractor Cost ($):	$350
Estimated Annual Natural Gas Savings ($):	$404	PBEEEP Provider Cost for Implementation Assistance ($):	$78
		Total Estimated Implementation Cost ($):	$428

Estimated Annual Total Savings ($):	$404	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	1.06	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	1.06	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	5	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	1.2%	Percent of Implementation Costs:	0.9%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Summary

Building: King Hall
Site: MSU Moorhead Part 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
3	AC-1 Cold deck reset schedule	$1,270	$607	2.09	$0	2.09	13
2	AC-1 enthalpy and economizer control.	$7,020	$2,521	2.79	$0	2.79	33
	Total for Findings with Payback 3 years or less:	**$8,290**	**$3,127**	**2.65**	**$0**	**2.65**	**46**
	Total for all Findings:	**$8,290**	**$3,127**	**2.65**	**$0**	**2.65**	**46**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: King Hall

FWB Number:	11555	Eco Number:	2
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	AC-1 enthalpy and economizer control.	Date Identified:	4/28/2012
Description of Finding:	The economizer is locked out at 70 degrees and enthalpy control is not being used. No outside air is being brought in above 70 degrees OAT. The OA damper modulates below 70 degrees OAT to maintain a 55 degree MAT. The Cold Deck DAT is higher than that causing the preheat coil to reheat the air.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Economizer/Outside Air Loads
Finding Type:	Economizer Operation - Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)		

Implementer:	Controls contractor. Balance Contractor.	Benefits:	Lower gas consumption. Lower electrical consumption.
Baseline Documentation Method:	The averageif statement show that the trending of the OA Temp, Return Air, Mixed Air Temp, Mixed Air Temp, and Cold Deck Air Temp.		
Measure:	Reprogram the AHU to control the OA damper to modulate to cold deck air temp.		
Recommendation for Implementation:	Reprogram the that the minimum OA is 15%. Add a humidity sensor into the RA duct and program the AHU to use enthalpy control to maximize the amount of free cooling by comparing OA enthalpy and RA enthalpy. Reprogram the AHU to modulate the OA damper to the cold deck setpoint.		
Evidence of Implementation Method:	Trend the SF status/speed, OA Temp, OA Enthalpy, Return Air, RA enthalpy, OA damper position, preheat valve position, Mixed Air Temp, and Cold Deck Air Temp for two weeks at 15 minute intervals when the OA temperature is between 80 and 60. Additional trending should be conducted when the OAT is below 40 degrees to verify that the OA damper is modulating to Cold Deck temperature.		

Annual Electric Savings (kWh): Estimated Annual kWh Savings ($):	4,469 $142	Peak Demand Savings (kWh): Estimated Annual Demand Savings ($):	-13 $-233
Annual Natural Gas Savings (therms): Estimated Annual Natural Gas Savings ($):	5,318 $2,611	Contractor Cost ($): PBEEEP Provider Cost for Implementation Assistance ($): Total Estimated Implementation Cost ($):	$6,399 $621 $7,020

Estimated Annual Total Savings ($): Initial Simple Payback (years): Simple Payback w/ Utility Co-Funding (years): GHG Avoided in U.S. Tons (C02e):	$2,521 2.79 2.79 33	Utility Co-Funding for kWh ($): Utility Co-Funding for kW ($): Utility Co-Funding for therms ($): Utility Co-Funding - Estimated Total ($):	$0 $0 $0 $0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	7.5%	Percent of Implementation Costs:	14.6%

Findings Details

Building: King Hall

FWB Number:	11555	Eco Number:	3
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	AC-1 Cold deck reset schedule	Date Identified:	12/14/2011
Description of Finding:	When the OAT is 60 and above the cold deck temperature is 55 degree.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls Problems
Finding Type:	Other Controls		

Implementer:	Controls contractor.	Benefits:	Lower electrical consumption.
Baseline Documentation Method:	Trending the OA Temp, RAT, MA Damper position. The averageif statement for setting the baselines show this is prevalent.		
Measure:	Reprogram the AHU to reset the cold deck discharge air temperature based on OAT.		
Recommendation for Implementation:	Reprogram the AHU to reset the cold deck discharge air based on OAT. When the OAT is 60 the cold deck discharge air shall be 60, resetting up to 65 degrees F when the OAT is 0 degrees F. When the OAT is 95 the cold deck discharge air shall be 55 degrees F.		
Evidence of Implementation Method:	Trend the OA temp and cold deck temperature for two weeks at 15 minute intervals when the OA temperature is between 90 and 70.		

Annual Electric Savings (kWh):	12,297	Annual Natural Gas Savings (therms):	441
Estimated Annual kWh Savings ($):	$390	Estimated Annual Natural Gas Savings ($):	$217
Contractor Cost ($):	$960		
PBEEEP Provider Cost for Implementation Assistance ($):	$311		
Total Estimated Implementation Cost ($):	$1,270		

Estimated Annual Total Savings ($):	$607	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	2.09	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	2.09	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	13	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	1.8%	Percent of Implementation Costs:	2.6%

Findings Summary

Building: Maintenance Building
Site: MSU Moorhead Part 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
1	S2 leaking steam valve.	$460	$36	12.82	$0	12.82	0
	Total for Findings with Payback 3 years or less:	**$0**	**$0**	**0.00**	**$0**	**0.00**	**0**
	Total for all Findings:	**$460**	**$36**	**12.82**	**$0**	**12.82**	**0**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Maintenance Building

FWB Number:	11558	Eco Number:	1
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	S2 leaking steam valve.	Date Identified:	1/9/2012
Description of Finding:	There is a rise of 1.5 degrees during occupied mode while the steam valve is closed. The MAT during unoccupied mode climbs to 100+ degrees.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Maintenance Related Problems
Finding Type:	Leaky/Stuck Valve		

Implementer:	Mechanical Contractor.	Benefits:	Lower Gas Usage.
Baseline Documentation Method:	Trending of the steam valve position, mat, sat, and rat. Trending show a significant increase in temperature from the mixed air temperature. Also during unoccupied times the MAT is around 120 degrees.		
Measure:	Replace the steam valve.		
Recommendation for Implementation:	Replace the steam valve and actuator. Replace with the same pneumatic actuator.		
Evidence of Implementation Method:	Trend the Fan Status, MAT, RAT, Htg Vlv, and DAT for a period of two weeks when the OAT is below 50 degrees at 15 minute intervals.		

Annual Natural Gas Savings (therms):	73	Contractor Cost ($):	$305
Estimated Annual Natural Gas Savings ($):	$36	PBEEEP Provider Cost for Implementation Assistance ($):	$155
		Total Estimated Implementation Cost ($):	$460

Estimated Annual Total Savings ($):	$36	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	12.82	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	12.82	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	0	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.1%	Percent of Implementation Costs:	1.0%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Summary

Building: Murray Commons
Site: MSU Moorhead Part 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
1	Failed end of main condensate trap	$580	$1,290	0.45	$0	0.45	15
7	AC-3 is over cooling and overheating the space	$920	$131	7.04	$0	7.04	2
4	AC-1 is over cooling the space and over heating the space.	$810	$103	7.85	$0	7.85	2
	Total for Findings with Payback 3 years or less:	**$580**	**$1,290**	**0.45**	**$0**	**0.45**	**15**
	Total for all Findings:	**$2,310**	**$1,524**	**1.52**	**$0**	**1.52**	**18**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Murray Commons

FWB Number:	11559	Eco Number:	1
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	Failed end of main condensate trap	Date Identified:	11/2/2011
Description of Finding:	The condensate trap and downstream piping was 200 degrees. The condensate trap is a Mepco model 44-215A with 3/4" NPT with an office size of 0.313. Room E101.		
Equipment or System(s):	Boiler Plant	Finding Category:	OTHER
Finding Type:	Other		

Implementer:	Steam Contractor	Benefits:	Reduced steam usage. The room temperature will decrease which will reduce the heat radiated to the first and second floors.
Baseline Documentation Method:	The room was warm and you could feel the heat radiating off the tank. I measure the condensate piping and trap temperature and insulated piping temperature with a temperature gun infrared thermometer. The condensate trap and downstream piping was 200 degrees for over 10 feet. The condensate trap is a Mepco model 44-215A with 3/4" NPT with an office size of 0.313. Room E101.		
Measure:	Replace the condensate trap.		
Recommendation for Implementation:	Remove and replace the steam condensate trap with the same make and model as currently installed. Mepco model 44-215A with 3/4" NPT.		
Evidence of Implementation Method:	Pictures of the old trap and the new installed trap.		

Annual Natural Gas Savings (therms):	2,628	Contractor Cost ($):	$425
Estimated Annual Natural Gas Savings ($):	$1,290	PBEEEP Provider Cost for Implementation Assistance ($):	$155
		Total Estimated Implementation Cost ($):	$580

Estimated Annual Total Savings ($):	$1,290	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.45	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.45	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	15	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	3.8%	Percent of Implementation Costs:	1.2%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Murray Commons

FWB Number:	11559	Eco Number:	4
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	AC-1 is over cooling the space and over heating the space.	Date Identified:	12/7/2011
Description of Finding:	AC-1 is over cooling during the summer and over heating during the winter for the areas served by this air handling unit. The trended space temps ranged between 70-72. According to Minnesota State setpoints for the winter of 68-70 and for the summer 74-76.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Zone setpoint setup/setback are not implemented or are sub-optimal		

Implementer:	Controls Contractor	Benefits:	Reduced heating and cooling loads.
Baseline Documentation Method:	Trending of RAT, OAT, MAT, DAT, supply fan status, and Room temps. There is pneumatic stats that control the space temperatures and are not adjusted depending on summer or winter. The RAT is 72 degrees year round and space temps of 72-70 degrees. This is shown on the baseline calculations.		
Measure:	Install new DDC Thermostats for room 1 and room 2.		
Recommendation for Implementation:	Install new DDC controlled Thermostats for the 2 Rooms that currently have thermostats. Replace with thermostats that are not user adjustable except through the front end software. The thermostats are located in room 204 and 233N. Program setpoint to be within state requirements.		
Evidence of Implementation Method:	Trend the room temperatures for a week for these two thermostats and compare to the corresponding setpoints at 15 minute intervals. This should be trended during heating and cooling seasons. Confirm winter setpoint of 68-70. Confirm summer setpoint of 74-76.		

Annual Electric Savings (kWh):	821	Annual Natural Gas Savings (therms):	157
Estimated Annual kWh Savings ($):	$26	Estimated Annual Natural Gas Savings ($):	$77
Contractor Cost ($):	$655		
PBEEEP Provider Cost for Implementation Assistance ($):	$155		
Total Estimated Implementation Cost ($):	$810		

Estimated Annual Total Savings ($):	$103	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	7.85	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	7.85	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	2	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.3%	Percent of Implementation Costs:	1.7%

Findings Details

Building: Murray Commons

FWB Number:	11559	Eco Number:	7
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	AC-3 is over cooling and overheating the space	Date Identified:	4/30/2012
Description of Finding:	AC-3 is over cooling during the summer and over heating during the winter for the areas served by this air handling unit. The trended space temps ranged between 68-74. According to Minnesota State setpoints for the winter of 68-70 and for the summer 74-76.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Zone setpoint setup/setback are not implemented or are sub-optimal		

Implementer:	Controls Contractor	Benefits:	Reduced heating and cooling loads.
Baseline Documentation Method:	Trending of RAT, OAT, MAT, DAT, supply fan status, and Room temps. This is shown on the baseline calculations.		
Measure:	Change setpoints		
Recommendation for Implementation:	Change the setpoints on the BAS for each of the spaces to be 68 degrees in the winter when the heating pumps are on and 75 degrees in the summer when the chiller is on. This could be done globally and would be an easy change.		
Evidence of Implementation Method:	Trend the room temperatures for a week for these two thermostats and compare to the corresponding setpoints at 15 minute intervals. This should be trended during heating and cooling seasons. Confirm winter setpoint of 68-70. Confirm summer setpoint of 74-76.		

Annual Electric Savings (kWh):	83	Annual Natural Gas Savings (therms):	261
Estimated Annual kWh Savings ($):	$3	Estimated Annual Natural Gas Savings ($):	$128
Contractor Cost ($):	$610		
PBEEEP Provider Cost for Implementation Assistance ($):	$311		
Total Estimated Implementation Cost ($):	$920		

Estimated Annual Total Savings ($):	$131	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	7.04	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	7.04	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	2	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.4%	Percent of Implementation Costs:	1.9%

Findings Summary

Building: Wellness Center
Site: MSU Moorhead Part 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
8	AHU 2 overheating and over cooling the space.	$690	$509	1.35	$0	1.35	10
5	AHU1 overheating and overcooling the space	$580	$193	3.01	$0	3.01	5
4	Optimize AHU1 economizer	$920	$295	3.12	$0	3.12	8
7	AHU 2 return fan overpressurizing and economizer	$1,150	$225	5.12	$0	5.12	5
2	VAV-28: Room 100 room temperature does not meet setpoint	$1,960	$346	5.66	$0	5.66	4
3	VAV-23: Room 122 room temperature does not meet setpoint	$1,960	$150	13.10	$0	13.10	2
	Total for Findings with Payback 3 years or less:	**$690**	**$509**	**1.35**	**$0**	**1.35**	**10**
	Total for all Findings:	**$7,260**	**$1,718**	**4.23**	**$0**	**4.23**	**34**

Findings Details

Building: Wellness Center

FWB Number:	11560	Eco Number:	2
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	VAV-28: Room 100 room temperature does not meet setpoint	Date Identified:	11/18/2011
Description of Finding:	During the winter months the space temperature is not achieved. The discharge air temperature is approximately 120 degrees. The air flow is stratified in this atrium. The grille is located on the vertical wall blowing across the ceiling. Two feet below grille is open to the second floor, the VAV box serving that area is in constant cooling, because the hot air escapes to the second floor rather than being forced down to the first floor. Simultaneous heating and cooling was not calculated in these savings, but the energy savings could be greater than anticipated.		
Equipment or System(s):	Other	Finding Category:	Retrofits
Finding Type:	Other Retrofit		

Implementer:	Mechanical Contractor
Benefits:	Heating savings and thermal comfort.
Baseline Documentation Method:	The stat is not meeting setpoint of 68 degrees and the heating valve on the vav box is 100 percent open during the day. There are approximately 3000 hours below the 50 degrees, when the AHU is on.
Measure:	Install destratification fan that is tied into the automation system.
Recommendation for Implementation:	Install the hanging destratification fan and install controls to interlock the fan to operate when AHU-2 is in occupied mode. Basis of design was the Air Pear Destratification fan. Location of fan to be determined with the assistance of the PBEEEP Provider.
Evidence of Implementation Method:	Trend VAV-28 box discharge air temp, air flow, and room temp for 2 weeks when the OAT is below 50 degrees.

Annual Electric Savings (kWh):	-149	Annual Natural Gas Savings (therms):	715
Estimated Annual kWh Savings ($):	$-5	Estimated Annual Natural Gas Savings ($):	$351
Contractor Cost ($):	$1,805		
PBEEEP Provider Cost for Implementation Assistance ($):	$155		
Total Estimated Implementation Cost ($):	$1,960		

Estimated Annual Total Savings ($):	$346	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	5.66	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	5.66	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	4	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	1.0%	Percent of Implementation Costs:	4.1%

Findings Details

Building: Wellness Center

FWB Number:	11560	Eco Number:	3
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	VAV-23: Room 122 room temperature does not meet setpoint	Date Identified:	11/18/2011
Description of Finding:	During the winter months the space temperature is not achieved. The discharge air temperature is approximately 90 degrees. The air flow is stratified in this atrium.		
Equipment or System(s):	Other	Finding Category:	Retrofits
Finding Type:	Other Retrofit		

Implementer:	Mechanical Contractor	Benefits:	Heating savings and thermal comfort.
Baseline Documentation Method:	The stat is not meeting setpoint of 68 degrees and the heating valve on the vav box is 100 percent open during the day. There are approximately 3000 hours below the 50 degrees, when the AHU is on.		
Measure:	Install destratification fan that is tied into the automation system.		
Recommendation for Implementation:	Install the hanging destratification fan and install controls to interlock the fan to operate when AHU-2 is in occupied mode. Basis of design was the Air Pear Destratification fan. Location of fan to be determined with the assistance of the PBEEEP Provider.		
Evidence of Implementation Method:	Trend the VAV-23 box discharge air temp, air flow, and room temp for 2 weeks when the OAT is below 50 degrees.		

Annual Electric Savings (kWh):	-149	Annual Natural Gas Savings (therms):	314
Estimated Annual kWh Savings ($):	$-5	Estimated Annual Natural Gas Savings ($):	$154
Contractor Cost ($):	$1,805		
PBEEEP Provider Cost for Implementation Assistance ($):	$155		
Total Estimated Implementation Cost ($):	$1,960		

Estimated Annual Total Savings ($):	$150	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	13.10	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	13.10	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	2	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.4%	Percent of Implementation Costs:	4.1%

Findings Details

Building: Wellness Center

FWB Number:	11560	Eco Number:	4
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	Optimize AHU1 economizer	Date Identified:	3/27/2011
Description of Finding:	The economizer is not optimized. The difference between the MAT, OAT, and DAT shows that the economizer is not working to the full extent.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Economizer/Outside Air Loads
Finding Type:	Economizer Operation - Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)		

Implementer:	Controls Contractor	Benefits:	Lower electrical consumption
Baseline Documentation Method:	Trending of the OAT, RAT, MAT, and DAT shows that the economizer is not functioning as desired. The averageif of the trends show that the DAT is lower than the MAT but that OA could be used for additional free cooling.		
Measure:	Optimize the economizer function.		
Recommendation for Implementation:	Change the economizer lockout to 71 deg F. Control the damper to be 100% open at 71 deg F OAT and modulate according to meet DAT setpoint.		
Evidence of Implementation Method:	Trend the Supply Fan Status, MAD %, OAT, MAT, RAT, DAT for two weeks when the OAT is between 80 and 50 degrees at 15 minute intervals.		

Annual Electric Savings (kWh):	9,307	Contractor Cost ($):	$610
Estimated Annual kWh Savings ($):	$295	PBEEEP Provider Cost for Implementation Assistance ($):	$311
		Total Estimated Implementation Cost ($):	$920

Estimated Annual Total Savings ($):	$295	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	3.12	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	3.12	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	8	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.9%	Percent of Implementation Costs:	1.9%

Findings Details

Building: Wellness Center

FWB Number:	11560	Eco Number:	5
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	AHU1 overheating and overcooling the space	Date Identified:	3/27/2011
Description of Finding:	The RAT is approximately 70 degrees year round. The set points for summer should be 75 degrees and 69 degrees in the winter.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Zone setpoint setup/setback are not implemented or are sub-optimal		

Implementer:	Controls Contractor	Benefits:	Lower electrical and gas consumption.
Baseline Documentation Method:	The averageif statement shows that the RAT is approximately 70 degrees year round.		
Measure:	Setpoints are suboptimal		
Recommendation for Implementation:	Set the setpoints to be 69 degrees when the OAT is below 40 degrees and when the OAT is above 65 the room temperature should be 75 degrees.		
Evidence of Implementation Method:	Trend the RAT or space temperature for two weeks when the OAT is below 40 degrees and above 65 degrees at 15 minute intervals.		

Annual Electric Savings (kWh):	5,797	Annual Natural Gas Savings (therms):	18
Estimated Annual kWh Savings ($):	$184	Estimated Annual Natural Gas Savings ($):	$9
Contractor Cost ($):	$425		
PBEEEP Provider Cost for Implementation Assistance ($):	$155		
Total Estimated Implementation Cost ($):	$580		

Estimated Annual Total Savings ($):	$193	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	3.01	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	3.01	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	5	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.6%	Percent of Implementation Costs:	1.2%

Findings Details

Building: Wellness Center

FWB Number:	11560	Eco Number:	7
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	AHU 2 return fan overpressurizing and economizer	Date Identified:	3/27/2011
Description of Finding:	When placing Data loggers the MA plenum door was held open and air was felt rushing out of the door. The door should be held shut due to the supply fan sucking in the OA. Trending shows that the MA damper is 27% open but the mixed air shows that only 10 percent of outdoor air is mixed. This also shows that the return fan is over pressuring the MA damper.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Economizer/Outside Air Loads
Finding Type:	Economizer Operation - Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)		

Implementer:	Controls contractor and balancing contractor	Benefits:	Lower electrical and gas consumption.
Baseline Documentation Method:	Trending of the OAT, RAT, MAT, and DAT shows that the economizer is not functioning as desired. The averageif of the trends show that the DAT is lower than the MAT but that OA could be used for additional free cooling. The return air fan is also overpressurizing the MA plenum.		
Measure:	Optimize the economizer and balance the return air fan.		
Recommendation for Implementation:	Balance the return fan at 4 different damper positions. The return fan should not over pressurize the mixed air plenum. Balancing should slow down the return fan and give an offset from the supply fan. A 3% return fan speed offset (slower) from the supply fan speed is proposed.		
Evidence of Implementation Method:	Trend the SF Speed, RF Speed, MAD %, RAT, MAT, DAT, and OAT for 4 weeks when the OAT is between 80 degrees and 40 degrees at 15 minute intervals.		

Annual Electric Savings (kWh):	5,603	Annual Natural Gas Savings (therms):	96
Estimated Annual kWh Savings ($):	$178	Estimated Annual Natural Gas Savings ($):	$47
Contractor Cost ($):	$995		
PBEEEP Provider Cost for Implementation Assistance ($):	$155		
Total Estimated Implementation Cost ($):	$1,150		

Estimated Annual Total Savings ($):	$225	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	5.12	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	5.12	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	5	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.7%	Percent of Implementation Costs:	2.4%

Findings Details

Building: Wellness Center

FWB Number:	11560	Eco Number:	8
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	AHU 2 overheating and over cooling the space.	Date Identified:	3/27/2011
Description of Finding:	The return air temperature is 74 degrees in the winter and 70 degrees in the summer. There are rooms that could have even lower temperatures.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Zone setpoint setup/setback are not implemented or are sub-optimal		

Implementer:	Controls Contractor	Benefits:	Lower electrical and gas consumption.
Baseline Documentation Method:	The averageif statement shows that the RAT between 74 and 70 degrees.		
Measure:	Setpoints are suboptimal		
Recommendation for Implementation:	Set the heating mode zone setpoints to be 69 degrees. Set the cooling mode zone setpoints to be 75 degrees. Note that these setpoints are for the zone temperature, and savings have been calculated from the change in return air temperature from pre and post implementation.		
Evidence of Implementation Method:	Trend the RAT or space temperature for two weeks when the OAT is below 40 degrees and above 65 degrees at 15 minute intervals.		

Annual Electric Savings (kWh):	8,197	Annual Natural Gas Savings (therms):	508
Estimated Annual kWh Savings ($):	$260	Estimated Annual Natural Gas Savings ($):	$250
Contractor Cost ($):	$535		
PBEEEP Provider Cost for Implementation Assistance ($):	$155		
Total Estimated Implementation Cost ($):	$690		

Estimated Annual Total Savings ($):	$509	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	1.35	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	1.35	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	10	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	1.5%	Percent of Implementation Costs:	1.4%

Findings Summary

Building: Center for the Arts
Site: MSU Moorhead Part 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
8	AAHU-2 runs excessively.	$810	$3,281	0.25	$0	0.25	68
7	AAHU-1 runs excessively.	$1,150	$3,615	0.32	$0	0.32	77
11	AAHU-2 is overcooling and overheating the space.	$1,150	$2,587	0.44	$0	0.44	8
19	AAHU-2 is over ventilating the space	$1,425	$1,737	0.82	$0	0.82	23
18	AC-2 is running excessively.	$921	$998	0.92	$0	0.92	17
23	S-4 is operating for too many hours.	$1,040	$890	1.17	$0	1.17	13
9	AAHU-1 is over ventilating the space	$1,381	$1,015	1.36	$0	1.36	12
16	AHU-S7 excessive run time	$2,990	$2,097	1.43	$0	1.43	42
10	AAHU-1 is overcooling the space and over heating the space.	$1,150	$498	2.31	$0	2.31	10
24	S-4 is over cooling and over heating the space	$810	$166	4.89	$0	4.89	3
13	AAHU-3 is over cooling and over heating the space.	$1,150	$184	6.24	$0	6.24	3
14	AC-2 is over heating and over cooling the spaces	$1,840	$183	10.07	$0	10.07	3
17	EF-30 excessive run time	$280	$24	11.85	$0	11.85	1
15	AC-3 is over cooling and over heating the spaces.	$4,141	$292	14.17	$0	14.17	6
	Total for Findings with Payback 3 years or less:	**$12,018**	**$16,717**	**0.72**	**$0**	**0.72**	**270**
	Total for all Findings:	**$20,239**	**$17,566**	**1.15**	**$0**	**1.15**	**285**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

PBEEEP State Government

Building: Center for the Arts

FWB Number:	11561	Eco Number:	7
Site:	MSU Moorhead Part 2	Date/Time Created:	5/31/2012

Investigation Finding:	AAHU-1 runs excessively.	Date Identified:	11/28/2011
Description of Finding:	The unit runs 24/7 to keep pianos rooms at a constant temperature and humidity. Humidity Sensor CAAhu1Rm100Rh.PointValue reads between 8 and 11 during the month of July.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	Controls Contractor.	Benefits:	Lower electrical consumption. Lower gas consumption.
Baseline Documentation Method:	The screen shot shows that the unit runs 24/7 and so does the trending data. Trending of the humidity sensor shows very little modulation while the other sensors range by 40% over the coarse of the trending. Trends shows of the 5 humidity sensors shows that this one it not reading correctly. Three of the humidity sensors during the month of July average 56% and the one that isn't reading correctly reads 9%.		
Measure:	Reprogram the unit to operate between 6 am and 10 pm 7 days a week.		
Recommendation for Implementation:	Reprogram the AHU to operate between 6 am and 10 pm 7 days a week. The air handling unit will be programmed to turned on as needed to control the temperature and humidity in the piano spaces during unoccupied time. The current occupied setpoint is 70 degrees and would be kept the same for this measure. Night setbacks would be set on 4 degrees any of occupied setpoint points (66 and 74). The humidity should be kept at 40% year round. If the humidity during unoccupied times vary by more than 20%, the AHU would be scheduled back on to keep the humidity at the optimal level. The AHU if scheduled on during unoccupied times the OA damper shall remain closed. The RH sensor in room 100 needs to be replaced with the same make and model currently installed. This needs to be done because calibrating the sensor when it is miss reading by the degree that it currently is.		
Evidence of Implementation Method:	Trend Supply fan status, DAT, and all the room relative humidity points for a period of two weeks at 15 minute intervals. Adjust relative humidity setpoints for turning on the air handling unit as required to maintain space humidity as required. Trend the humidity sensor for room 100 for 15 minute intervals for 2 weeks and compare the other humidity sensors on the same system.		

Annual Electric Savings (kWh):	72,429	Annual Natural Gas Savings (therms):	2,686
Estimated Annual kWh Savings ($):	$2,296	Estimated Annual Natural Gas Savings ($):	$1,319
Contractor Cost ($):	$995		
PBEEEP Provider Cost for Implementation Assistance ($):	$155		
Total Estimated Implementation Cost ($):	$1,150		

Estimated Annual Total Savings ($):	$3,615	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.32	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.32	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	77	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	10.8%	Percent of Implementation Costs:	2.4%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Center for the Arts

FWB Number:	11561	Eco Number:	8
Site:	MSU Moorhead Part 2	Date/Time Created:	5/31/2012

Investigation Finding:	AAHU-2 runs excessively.	Date Identified:	11/28/2011
Description of Finding:	The unit runs 24/7 to keep pianos rooms at a constant temperature and humidity.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	Controls Contractor.	Benefits:	Lower electrical consumption. Lower gas consumption.
Baseline Documentation Method:	The screen shot shows that the unit runs 24/7 and so does the trending data.		
Measure:	Reprogram the unit to operate between 6 am and 10 pm 7 days a week.		
Recommendation for Implementation:	Reprogram the AHU to operate between 6 am and 10 pm 7 days a week. The air handling unit will be programmed to turned on as needed to control the temperature and humidity in the piano spaces during unoccupied time. The current occupied setpoint is 70 degrees and would be kept the same for this measure. Night setbacks would be set on 4 degrees any of occupied setpoint points (66 and 74). The humidity should be kept at 40% year round. If the humidity during unoccupied times vary by more than 20%, the AHU would be scheduled back on to keep the humidity at the optimal level. The AHU if scheduled on during unoccupied times the OA damper shall remain closed.		
Evidence of Implementation Method:	Trend Supply fan status, DAT, and all the room relative humidity points for a period of two weeks at 15 minute intervals. Adjust relative humidity setpoints for turning on the air handling unit as required to maintain space humidity as required.		

Annual Electric Savings (kWh):	63,020	Annual Natural Gas Savings (therms):	2,614
Estimated Annual kWh Savings ($):	$1,998	Estimated Annual Natural Gas Savings ($):	$1,283
Contractor Cost ($):	$655		
PBEEEP Provider Cost for Implementation Assistance ($):	$155		
Total Estimated Implementation Cost ($):	$810		

Estimated Annual Total Savings ($):	$3,281	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.25	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.25	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	68	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	9.8%	Percent of Implementation Costs:	1.7%

Findings Details

Building: Center for the Arts

FWB Number:	11561	Eco Number:	9
Site:	MSU Moorhead Part 2	Date/Time Created:	5/31/2012

Investigation Finding:	AAHU-1 is over ventilating the space	Date Identified:	11/29/2011
Description of Finding:	The air handling unit averages 36% outside air. The air handling unit does fully utilize the economizer controls.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Economizer/Outside Air Loads
Finding Type:	Other Economizer/OA Loads		

Implementer:	Controls Contractor.	Benefits:	Lower electrical consumption. Lower Gas consumption.
Baseline Documentation Method:	Trending shows that the outside air ranges between ~34% and ~20% during non economizer mode. The trending show that economizer is not being used to the full potential with little economizer function.		
Measure:	Reprogram the AHU to a reduced air flow and maximize the economizer.		
Recommendation for Implementation:	Based on the area and space types that the outside air is higher than needed. The space type is office space and classroom spaces. Based on that type of spaces the outside air cfm should be approximately 3000 cfm. This will have to verified and more engineering complete to determine the exact minimum OA needed for the space. Based on 3000 cfm of OA the percentage of OA would be 15%. A balancing contractor shall perform the rebalancing of the minimum OA. Reprogram the AHU to maintain the minimum of 15% during occupied times. Reprogram the economizer to function between 71 and 40 degrees and maintain a 60 degree discharge temperature.		
Evidence of Implementation Method:	Trend the OAT, RAT, MAT, OA damper position, MA damper position and fan status for a minimum of 15 minute intervals for a period when the OAT is between 80 and 50 degrees for 2 weeks.		

Annual Electric Savings (kWh):	7,346	Peak Demand Savings (kWh):	14
Estimated Annual kWh Savings ($):	$233	Estimated Annual Demand Savings ($):	$248
Annual Natural Gas Savings (therms):	1,089	Contractor Cost ($):	$1,070
Estimated Annual Natural Gas Savings ($):	$535	PBEEEP Provider Cost for Implementation Assistance ($):	$311
		Total Estimated Implementation Cost ($):	$1,381

Estimated Annual Total Savings ($):	$1,015	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	1.36	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	1.36	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	12	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	3.0%	Percent of Implementation Costs:	2.9%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Center for the Arts

FWB Number:	11561	Eco Number:	10
Site:	MSU Moorhead Part 2	Date/Time Created:	5/31/2012

Investigation Finding:	AAHU-1 is overcooling the space and over heating the space.	Date Identified:	11/29/2011
Description of Finding:	The return air ranges between 72 and 64 degrees. The space temperature in room temperature ranges between 61 and 71 degrees.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls Problems
Finding Type:	Other Controls		

Implementer:	Controls Contractor. Mechanical Contractor.	Benefits:	Lower electrical consumption. Lower Gas consumption.
Baseline Documentation Method:	Trending shows that the return air temperature is 71 degrees between OAT of 50-0 degrees. During the summer months the trends show that the return air temperature varies between 66 and 72 degrees.		
Measure:	Reprogram the AHU to control the discharge air temp based on return air temperature.		
Recommendation for Implementation:	Reprogram the AHU to control the discharge air temp based on return air temperature. The return air temperature in the winter shall be 69 degrees and during the summer months the return air temperature shall be 75 degrees. A mechanical contractor shall adjust the pneumatic thermostats that serve the FTR in the spaces to be set at 68 degrees. The acts as the space reheat during the winter months and would need to be adjusted.		
Evidence of Implementation Method:	Trending of the OAT, RAT, and DAT for a minimum of 15 minutes for two weeks during the summer time when the OAT is above 75 and for two weeks during the winter months when the OAT is below 40 degrees.		

Annual Electric Savings (kWh):	7,767	Annual Natural Gas Savings (therms):	513
Estimated Annual kWh Savings ($):	$246	Estimated Annual Natural Gas Savings ($):	$252
Contractor Cost ($):	$995		
PBEEEP Provider Cost for Implementation Assistance ($):	$155		
Total Estimated Implementation Cost ($):	$1,150		

Estimated Annual Total Savings ($):	$498	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	2.31	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	2.31	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	10	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	1.5%	Percent of Implementation Costs:	2.4%

Findings Details

Building: Center for the Arts

FWB Number:	11561	Eco Number:	11
Site:	MSU Moorhead Part 2	Date/Time Created:	5/31/2012

Investigation Finding:	AAHU-2 is overcooling and overheating the space.	Date Identified:	11/29/2011
Description of Finding:	The return air ranges between 72 and 63 degrees. The space temperature in room temperature ranges between 61 and 73 degrees.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls Problems
Finding Type:	Other Controls		

Implementer:	Controls Contractor. Mechanical Contractor.	Benefits:	Lower electrical consumption. Lower Gas consumption.
Baseline Documentation Method:	Trending shows that the return air temperature is 72 degrees between OAT of 50-0 degrees. During the summer months the trends show that the return air temperature varies between 66 and 69 degrees.		
Measure:	Reprogram the AHU to control the discharge air temp based on return air temperature.		
Recommendation for Implementation:	Reprogram the AHU to control the discharge air temp based on return air temperature. The return air temperature in the winter shall be 69 degrees and during the summer months the return air temperature shall be 75 degrees. A mechanical contractor shall adjust the pneumatic thermostats that serve the FTR in the spaces to be set at 68 degrees. The acts as the space reheat during the winter months and would need to be adjusted.		
Evidence of Implementation Method:	Trending of the OAT, RAT, and DAT for a minimum of 15 minutes for two weeks during the summer time when the OAT is above 75 and for two weeks during the winter months when the OAT is below 40 degrees.		

Annual Electric Savings (kWh):	4,949	Annual Natural Gas Savings (therms):	4,949
Estimated Annual kWh Savings ($):	$157	Estimated Annual Natural Gas Savings ($):	$2,430
Contractor Cost ($):	$995		
PBEEEP Provider Cost for Implementation Assistance ($):	$155		
Total Estimated Implementation Cost ($):	$1,150		

Estimated Annual Total Savings ($):	$2,587	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.44	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.44	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	8	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	7.7%	Percent of Implementation Costs:	2.4%

Findings Details

Building: Center for the Arts

FWB Number:	11561	Eco Number:	13
Site:	MSU Moorhead Part 2	Date/Time Created:	5/31/2012

Investigation Finding:	AAHU-3 is over cooling and over heating the space.	Date Identified:	11/29/2011
Description of Finding:	Trending show that the return air temperature during the winter is 73 and during the summer 71. The space temperature ranges between 61 and 65 in the summer and 71 to 72 in the winter.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls Problems
Finding Type:	Other Controls		

Implementer:	Controls Contractor. Mechanical Contractor.	Benefits:	Lower electrical consumption. Lower Gas consumption.
Baseline Documentation Method:	Trending show that the return air temperature during the winter is 73 and during the summer 71. The space temperature ranges between 61 and 65 in the summer and 71 to 72 in the winter.		
Measure:	Reprogram the AHU to control the discharge air temp based on return air temperature.		
Recommendation for Implementation:	Reprogram the AHU to control the discharge air temp based on return air temperature. The return air temperature in the winter shall be 69 degrees and during the summer months the return air temperature shall be 75 degrees. A mechanical contractor shall adjust the pneumatic thermostats that serve the FTR in the spaces to be set at 68 degrees. This acts as the space reheat during the winter months and would need to be adjusted.		
Evidence of Implementation Method:	Trending of the OAT, RAT, and DAT for a minimum of 15 minutes for two weeks during the summer time when the OAT is above 75 and for two weeks during the winter months when the OAT is below 40 degrees.		

Annual Electric Savings (kWh):	878	Annual Natural Gas Savings (therms):	319
Estimated Annual kWh Savings ($):	$28	Estimated Annual Natural Gas Savings ($):	$157
Contractor Cost ($):	$995		
PBEEEP Provider Cost for Implementation Assistance ($):	$155		
Total Estimated Implementation Cost ($):	$1,150		

Estimated Annual Total Savings ($):	$184	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	6.24	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	6.24	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	3	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.5%	Percent of Implementation Costs:	2.4%

Findings Details

Building: Center for the Arts

FWB Number:	11561	Eco Number:	14
Site:	MSU Moorhead Part 2	Date/Time Created:	5/31/2012

Investigation Finding:	AC-2 is over heating and over cooling the spaces	Date Identified:	11/29/2011
Description of Finding:	The return air ranges between 72 and 65 degrees. The space temperature in room temperature ranges between 64 and 72 degrees.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls Problems
Finding Type:	Other Controls		

Implementer:	Controls Contractor.	Benefits:	Lower electrical consumption. Lower Gas consumption.
Baseline Documentation Method:	Trending show that the return air temperature during the winter is 72 and during the summer 70. The space temperature follows the same temperatures as the return air temperature.		
Measure:	Replace pneumatic stats with DDC Stats.		
Recommendation for Implementation:	Replace the 3-zone stats with DDC stats. Program the AHU zone dampers to maintain space temperature based on time of year. The space temperature in the winter shall be 69 degrees and during the summer months the return air temperature shall be 75 degrees.		
Evidence of Implementation Method:	Trending of the OAT, RAT, 3-zone temperatures and DAT for a minimum of 15 minutes for two weeks during the summer time when the OAT is above 75 and for two weeks during the winter months when the OAT is below 40 degrees.		

Annual Electric Savings (kWh):	2,842	Annual Natural Gas Savings (therms):	189
Estimated Annual kWh Savings ($):	$90	Estimated Annual Natural Gas Savings ($):	$93
Contractor Cost ($):	$1,685		
PBEEEP Provider Cost for Implementation Assistance ($):	$155		
Total Estimated Implementation Cost ($):	$1,840		

Estimated Annual Total Savings ($):	$183	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	10.07	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	10.07	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	3	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.5%	Percent of Implementation Costs:	3.8%

Findings Details

Building: Center for the Arts

FWB Number:	11561	Eco Number:	15
Site:	MSU Moorhead Part 2	Date/Time Created:	5/31/2012

Investigation Finding:	AC-3 is over cooling and over heating the spaces.	Date Identified:	11/29/2011
Description of Finding:	The return air temperature during the summer is 72 degrees and the return air temperature is during the winter is between 70 and 66 degrees.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls Problems
Finding Type:	Other Controls		

Implementer:	Controls Contractor. Mechanical Contractor.	Benefits:	Lower electrical consumption. Lower Gas consumption.
Baseline Documentation Method:	Trending shows that the return air temperature during the summer is 72 degrees and the return air temperature is during the winter is between 70 and 66 degrees. The multizone dampers are leaking allowing the spaces to over cool. This was also witnessed onsite that the dampers do not fully close. The mixed air damper is not modulating to maintain 55 degrees during the winter months.		
Measure:	Replace the 3 multizone dampers and actuators. Replace the mixed air damper.		
Recommendation for Implementation:	Replace the 3-zone stats with DDC stats. Program the AHU zone dampers to maintain space temperature based on time of year. Replace the 3 multizone dampers. Replace the zone actuators with DDC driven actuators. The space temperature in the winter shall be 69 degrees and during the summer months the return air temperature shall be 75 degree.		
Evidence of Implementation Method:	Trend the 3 zones temperatures, damper position, mixed air damper position and RAT for a minimum of 15 minutes for two weeks during the summer months when the Oat is above 75 degrees, for two weeks during the winter months when the OAT is below 40.		

Annual Electric Savings (kWh):	4,741	Annual Natural Gas Savings (therms):	289
Estimated Annual kWh Savings ($):	$150	Estimated Annual Natural Gas Savings ($):	$142
Contractor Cost ($):	$3,830		
PBEEEP Provider Cost for Implementation Assistance ($):	$311		
Total Estimated Implementation Cost ($):	$4,141		

Estimated Annual Total Savings ($):	$292	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	14.17	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	14.17	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	6	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.9%	Percent of Implementation Costs:	8.6%

Findings Details

Building: Center for the Arts

FWB Number:	11561	Eco Number:	16
Site:	MSU Moorhead Part 2	Date/Time Created:	5/31/2012

Investigation Finding:	AHU-S7 excessive run time	Date Identified:	12/2/2011
Description of Finding:	This unit operates by a wall switch. The professor stated that they turn on the unit and let it run during the entire school year. They don't turn it off because it will sometimes go into alarm and the fire alarm is set off.		
Equipment or System(s):	AHU with heating only	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	Controls Contractor.	Benefits:	Lower electrical consumption. Lower gas consumption.
Baseline Documentation Method:	Discharge air was trended on this unit along with outside air temperature.		
Measure:	Add basic controls to operate on a time schedule and also have an override button to operate after hours.		
Recommendation for Implementation:	Add basic controls to operate on a time schedule and also have an override button to operate after hours. Enable the unit to be on between 7am-6pm M-F. This unit is interlocked with a 5 hp exhaust fan on the roof. When the override button is activated the ahu and exhaust fan will run for 2 additional hours. Overlay the ddc on top of the pneumatic controls.		
Evidence of Implementation Method:	Trend fan status for a minimum of 15 minute intervals for a period of one month, while school is in session.		

Annual Electric Savings (kWh):	36,620	Annual Natural Gas Savings (therms):	1,906
Estimated Annual kWh Savings ($):	$1,161	Estimated Annual Natural Gas Savings ($):	$936
Contractor Cost ($):	$2,680		
PBEEEP Provider Cost for Implementation Assistance ($):	$311		
Total Estimated Implementation Cost ($):	$2,990		

Estimated Annual Total Savings ($):	$2,097	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	1.43	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	1.43	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	42	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	6.2%	Percent of Implementation Costs:	6.2%

Findings Details

Building: Center for the Arts

FWB Number:	11561	Eco Number:	17
Site:	MSU Moorhead Part 2	Date/Time Created:	5/31/2012

Investigation Finding:	EF-30 excessive run time	Date Identified:	12/2/2011
Description of Finding:	The exhaust fan is turned on by a wall switch. The wall switch is left on during the school year.		
Equipment or System(s):	Other	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	Electrical contractor.	Benefits:	Lower Electrical consumptions.
Baseline Documentation Method:	No trending. Visual observation and talking with the professor. I assumed that the exhaust fan is currently operating 24/7 during the school year.		
Measure:	Add time control on the exhaust fan.		
Recommendation for Implementation:	Rewire the 120v switch to be a 2hr spring wound timer. Assume that the unit will run 8 hours a day during the school year.		
Evidence of Implementation Method:	Visual inspection and receipts.		

Annual Electric Savings (kWh):	745	Contractor Cost ($):	$230
Estimated Annual kWh Savings ($):	$24	PBEEEP Provider Cost for Implementation Assistance ($):	$50
		Total Estimated Implementation Cost ($):	$280

Estimated Annual Total Savings ($):	$24	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	11.85	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	11.85	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	1	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.1%	Percent of Implementation Costs:	0.6%

Findings Details

Building: Center for the Arts

FWB Number:	11561	Eco Number:	18
Site:	MSU Moorhead Part 2	Date/Time Created:	5/31/2012

Investigation Finding:	AC-2 is running excessively.	Date Identified:	12/2/2011
Description of Finding:	The unit runs 24/7 to keep pianos rooms at a constant temperature and humidity.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	Controls Contractor.	Benefits:	Lower electrical consumption. Lower gas consumption.
Baseline Documentation Method:	The screen shot shows that the unit runs 24/7 and so does the trending.		
Measure:	Reprogram the unit to operate between 6 am and 10 pm 7 days a week.		
Recommendation for Implementation:	Reprogram the AHU to operate between 6 am and 10 pm 7 days a week. The air handling unit will be programmed to turned on as needed to control the temperature and humidity in the piano spaces during unoccupied time. The current occupied setpoint is 70 degrees and would be kept the same for this measure. Night setbacks would be set on 4 degrees any of occupied setpoint points (66 and 74). The humidity should be kept at 40% year round. If the humidity during unoccupied times vary by more than 20%, the AHU would be scheduled back on to keep the humidity at the optimal level. The AHU if scheduled on during unoccupied times the OA damper shall remain closed.		
Evidence of Implementation Method:	Trend Supply fan status, DAT, and all the room relative humidity points for a period of two weeks at 15 minute intervals. Adjust relative humidity setpoints for turning on the air handling unit as required to maintain space humidity as required.		

Annual Electric Savings (kWh):	11,384	Annual Natural Gas Savings (therms):	1,298
Estimated Annual kWh Savings ($):	$361	Estimated Annual Natural Gas Savings ($):	$637
Contractor Cost ($):	$610		
PBEEEP Provider Cost for Implementation Assistance ($):	$311		
Total Estimated Implementation Cost ($):	$921		

Estimated Annual Total Savings ($):	$998	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.92	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.92	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	17	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	3.0%	Percent of Implementation Costs:	1.9%

Findings Details

PBEEEP State Government

Building: Center for the Arts

FWB Number:	11561	Eco Number:	19
Site:	MSU Moorhead Part 2	Date/Time Created:	5/31/2012

Investigation Finding:	AAHU-2 is over ventilating the space	Date Identified:	2/12/2012
Description of Finding:	The air handling unit averages 42% outside air. The air handling unit does fully utilize the economizer controls.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Economizer/Outside Air Loads
Finding Type:	Other Economizer/OA Loads		

Implementer:	Controls Contractor.	Benefits:	Lower electrical consumption. Lower Gas consumption.
Baseline Documentation Method:	Trending shows that the outside air ranges between ~10% and ~30% during non economizer mode. The trending show that economizer is not being used to the full potential with little economizer function.		
Measure:	Reprogram the AHU to a reduced air flow and maximize the economizer.		
Recommendation for Implementation:	Based on the area and space types that the outside air is higher than needed. The space type is office space and classroom spaces. Based on that type of spaces the outside air cfm should be approximately 3000 cfm. This will have to verified and more engineering complete to determine the exact minimum OA needed for the space. Based on 3000 cfm of OA the percentage of OA would be 15%. A balancing contractor shall perform the rebalancing of the minimum OA. Reprogram the AHU to maintain the minimum of 15% during occupied times. Reprogram the economizer to function between 75 and 40 degrees and maintain a 60 degree discharge temperature.		
Evidence of Implementation Method:	Trend the OAT, RAT, MAT, OA damper position, MA damper position and fan status for a minimum of 15 minute intervals for a period when the OAT is between 80 and 50 degrees for 2 weeks.		

Annual Electric Savings (kWh):	7,551	Annual Natural Gas Savings (therms):	3,050
Estimated Annual kWh Savings ($):	$239	Estimated Annual Natural Gas Savings ($):	$1,497
Contractor Cost ($):	$1,070		
PBEEEP Provider Cost for Implementation Assistance ($):	$355		
Total Estimated Implementation Cost ($):	$1,425		

Estimated Annual Total Savings ($):	$1,737	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.82	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.82	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	23	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	5.2%	Percent of Implementation Costs:	3.0%

Findings Details

Building: Center for the Arts

FWB Number:	11561	Eco Number:	23
Site:	MSU Moorhead Part 2	Date/Time Created:	5/31/2012

Investigation Finding:	S-4 is operating for too many hours.	Date Identified:	3/2/2012
Description of Finding:	The unit is a make up air unit for the dust collector in the space. This space is rarely used and yet the AHU has a scheduled run time. I have walked through this space an many occasions and have found that the AHU is running and the lights are off with no occupants..		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	Controls Contractor. Mechanical Contractor.	Benefits:	Lower electrical consumption. Lower Gas consumption.
Baseline Documentation Method:	Trending shows that this AHU runs from 12pm-7pm M-F and 6 am to 10 pm on Saturday. This space is rarely used with little to no occupants. This unit operates for approximately 4000 hours a year, I estimate that this unit would not run for more than 3000 or less.		
Measure:	Add push button control on this AHU.		
Recommendation for Implementation:	Add a DDC operated push button override. This unit once the button is pushed will operate for two hours and then shut off. Tie this push button override into the DDC system and monitor the hours of operation for this AHU.		
Evidence of Implementation Method:	Trend motor status for a period of two weeks when during the school year or when this AHU is supposed to be operating with 15 minute intervals.		

Annual Electric Savings (kWh):	5,272	Annual Natural Gas Savings (therms):	1,471
Estimated Annual kWh Savings ($):	$167	Estimated Annual Natural Gas Savings ($):	$722
Contractor Cost ($):	$885		
PBEEEP Provider Cost for Implementation Assistance ($):	$155		
Total Estimated Implementation Cost ($):	$1,040		

Estimated Annual Total Savings ($):	$890	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	1.17	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	1.17	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	13	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	2.6%	Percent of Implementation Costs:	2.2%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Center for the Arts

FWB Number:	11561	Eco Number:	24
Site:	MSU Moorhead Part 2	Date/Time Created:	5/31/2012

Investigation Finding:	S-4 is over cooling and over heating the space	Date Identified:	3/2/2012
Description of Finding:	The return air temperature during the summer is 73 degrees and the return air temperature during the winter is 66-72 degrees.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls Problems
Finding Type:	Other Controls		

Implementer:	Controls Contractor. Mechanical Contractor.	Benefits:	Lower electrical consumption. Lower Gas consumption.
Baseline Documentation Method:	Trending show that the return air temperature during the winter is 66-72 and during the summer 73.		
Measure:	Replace the thermostat with a DDC thermostat		
Recommendation for Implementation:	Replace the pneumatic thermostat with a DDC thermostat. Program the unit to maintain space temperatures to be 76 degrees in the summer and 68 degrees in the winter.		
Evidence of Implementation Method:	Trend space temperature, OAT, and motor status for a period of two weeks in the summer with OAT above 75 and in the winter with OAT below 40. The recording interval shall be no more 15 minutes.		

Annual Electric Savings (kWh):	1,522	Annual Natural Gas Savings (therms):	239
Estimated Annual kWh Savings ($):	$48	Estimated Annual Natural Gas Savings ($):	$117
Contractor Cost ($):	$655		
PBEEEP Provider Cost for Implementation Assistance ($):	$155		
Total Estimated Implementation Cost ($):	$810		

Estimated Annual Total Savings ($):	$166	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	4.89	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	4.89	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	3	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.5%	Percent of Implementation Costs:	1.7%

Findings Summary

Building: Hagen Hall
Site: MSU Moorhead Part 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
6	HW Pumps 1-4 run continuously year round.	$920	$75	12.20	$0	12.20	2
	Total for Findings with Payback 3 years or less:	**$0**	**$0**	**0.00**	**$0**	**0.00**	**0**
	Total for all Findings:	**$920**	**$75**	**12.20**	**$0**	**12.20**	**2**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Hagen Hall

FWB Number:	11562	Eco Number:	6
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	HW Pumps 1-4 run continuously year round.	Date Identified:	12/12/2011
Description of Finding:	HW Pumps 1-4 run continuously year round. Pumps are running regardless of a need for hot water.		
Equipment or System(s):	Boiler Plant	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	Facility Staff	Benefits:	HW Pumps will not run when not required. Energy will be saved by less pump operation.
Baseline Documentation Method:	Building automation trends of hot water pumps HWP-1,2,3 and 4. (HX1-HWpump1&2.xlsx & HX2-HWpump3&4.xlsx).		
Measure:	Lower heating system lockout setpoint to 60 deg F (currently 90 deg F).		
Recommendation for Implementation:	The system heating lockout setpoint shall be set to an outside air temperature of 75 deg F. Verify the heating water pumps shut off when the OAT is greater than 75 deg F.		
Evidence of Implementation Method:	HWP 1,2,3 &4 VFD control status and speed point trended every 15 minutes for 3 consecutive months during a shoulder season. OA temperature point trended every 15 minutes for the same 3 consecutive months.		

Annual Electric Savings (kWh):	2,378	Contractor Cost ($):	$650
Estimated Annual kWh Savings ($):	$75	PBEEEP Provider Cost for Implementation Assistance ($):	$270
		Total Estimated Implementation Cost ($):	$920

Estimated Annual Total Savings ($):	$75	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	12.20	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	12.20	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	2	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.2%	Percent of Implementation Costs:	1.9%

Findings Summary

Building: Heating Plant
Site: MSU Moorhead Part 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
1	Split system temperature is to high	$38	$3	12.16	$0	12.16	0
	Total for Findings with Payback 3 years or less:	**$0**	**$0**	**0.00**	**$0**	**0.00**	**0**
	Total for all Findings:	**$38**	**$3**	**12.14**	**$0**	**12.14**	**0**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Heating Plant

FWB Number:	11563	Eco Number:	1
Site:	MSU Moorhead Part 2	Date/Time Created:	6/7/2012

Investigation Finding:	Split system temperature is to high	Date Identified:	11/1/2011
Description of Finding:	The room setpoint in the office is 72 degrees.		
Equipment or System(s):	AHU with heating only	Finding Category:	Controls Problems
Finding Type:	Other Controls		

Implementer:	Staff onsite	Benefits:	lower electrical consumption
Baseline Documentation Method:	Visual inspection shows that the setpoint is 72 degrees. There is no trendable data and with a small split system estimated run hours were used.		
Measure:	Manually adjust the temperature in the to be 76 degree compared to 72 degrees.		
Recommendation for Implementation:	Manually adjust the temperature in the to be 76 degree compared to 72 degrees.		
Evidence of Implementation Method:	Photograph		

Annual Electric Savings (kWh):	99	Contractor Cost ($):	$38
Estimated Annual kWh Savings ($):	$3	PBEEEP Provider Cost for Implementation Assistance ($):	$0
		Total Estimated Implementation Cost ($):	$38

Estimated Annual Total Savings ($):	$3	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	12.16	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	12.16	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	0	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.0%	Percent of Implementation Costs:	0.1%

Findings Summary

Building: MacLean Hall
Site: MSU Moorhead Part 2

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
4	AHU-2 is excessively scheduled	$620	$4,636	0.13	$0	0.13	88
2	AHU-1 Running overnight	$620	$41	15.28	$0	15.28	1
	Total for Findings with Payback 3 years or less:	**$620**	**$4,636**	**0.13**	**$0**	**0.13**	**88**
	Total for all Findings:	**$1,240**	**$4,677**	**0.27**	**$0**	**0.27**	**89**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: MacLean Hall

FWB Number:	11564	Eco Number:	2
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	AHU-1 Running overnight	Date Identified:	4/4/2012
Description of Finding:	AHU-1 ran continuously between the days of 7/17 - 7/22 and 7/25 - 7/30.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Equipment is enabled regardless of need, or such enabling is excessive		

Implementer:	Building Staff	Benefits:	Cooling and fan energy will be saved by not operating the unit when it is not needed
Baseline Documentation Method:	Trending data of AHU-1 supply fan status. Found in file MAC Lean.xlsx		
Measure:	Modify AHU-1 Scheduling to prevent operating 24/7.		
Recommendation for Implementation:	Modify the schedule of AHU-1 to be scheduled ON from 4:00 - 21:00 Monday, 6:00 - 21:00 Tuesday through Thursday, 6:00 - 22:00 Friday, and scheduled OFF on Saturday and Sunday.		
Evidence of Implementation Method:	Trends of AHU-1 Supply fan status control point trended ever 15 minutes for 3 consecutive months.		

Annual Electric Savings (kWh):	1,280	Contractor Cost ($):	$350
Estimated Annual kWh Savings ($):	$41	PBEEEP Provider Cost for Implementation Assistance ($):	$270
		Total Estimated Implementation Cost ($):	$620

Estimated Annual Total Savings ($):	$41	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	15.28	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	15.28	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	1	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.1%	Percent of Implementation Costs:	1.3%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: MacLean Hall

FWB Number:	11564	Eco Number:	4
Site:	MSU Moorhead Part 2	Date/Time Created:	5/30/2012

Investigation Finding:	AHU-2 is excessively scheduled	Date Identified:	4/4/2012
Description of Finding:	AHU-2 was observed to be running 24/7.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Equipment is enabled regardless of need, or such enabling is excessive		

Implementer:	Building Staff	Benefits:	Cooling and fan energy will be saved by not operating the unit when it is not needed
Baseline Documentation Method:	Trending data of AHU-2 supply and return fan status. Found in file MAC Lean.xlsx		
Measure:	Modify AHU-2 Scheduling to prevent operating 24/7.		
Recommendation for Implementation:	Modify the schedule of AHU-2 to be scheduled ON from 4:00 - 21:00 Monday, 6:00 - 21:00 Tuesday through Thursday, 6:00 - 22:00 Friday, and scheduled OFF on Saturday and Sunday.		
Evidence of Implementation Method:	Trends of AHU-2 Supply fan status control point trended ever 15 minutes for 3 consecutive months.		

Annual Electric Savings (kWh):	71,306	Annual Natural Gas Savings (therms):	4,839
Estimated Annual kWh Savings ($):	$2,260	Estimated Annual Natural Gas Savings ($):	$2,376
Contractor Cost ($):	$350		
PBEEEP Provider Cost for Implementation Assistance ($):	$270		
Total Estimated Implementation Cost ($):	$620		

Estimated Annual Total Savings ($):	$4,636	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.13	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.13	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	88	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	13.8%	Percent of Implementation Costs:	1.3%

PBEEEP State Government

Rev. 2.0 (12/16/2010)

11551 - MSU Moorhead/Bridges Hall

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive			Investigation looked for, but did not find this issue.	AHU1 follows the fuilding schedule, and ahu 2 operates about 2 hours a day.
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive			Investigation looked for, but did not find this issue.	
	a.3 (3)	Lighting is on more hours than necessary.			Investigation looked for, but did not find this issue.	Lighting follows the same schedule as the occupancy of the building.
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Not Relevant	
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Investigation looked for, but did not find this issue.	Free cooling is operating correctly.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	Finding 10			by reseting the mixed air temperature, will reduce the OA %.
	b.3 (7)	OTHER_Economizer/OA Loads			Investigation looked for, but did not find this issue.	the economizer is used to maintain a cold deck temperature
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive	Finding 11	AHU-1		The heating pumps overate during the summer months.
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	Finding 6	AHU-1		Cold deck temperature, hot deck, and MAT sensor needs to be replaced.
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	Finding 12			HX steam valves are hunting.
	c.4 (11)	OTHER_Controls	Finding 10			Cold deck reset should be implemented on AHU 1.
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Not Relevant	This building does not have this item.
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	Finding 8	AHU-1		The setpoint is 73 degrees for average room temperature.
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently			Not Relevant	no vfd's
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	no vfd's
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Not Relevant	This building does not have this item.
	d.6 (17)	Other_Controls (Setpoint Changes)			Not Relevant	
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	The reset schedule is 130-190
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	Chilled water system will be checked on MacLean Hall.
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Not Relevant	dual duct system, no supply air temperature reset is availible.
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Not Relevant	constant volume system
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Not Relevant	there is no condenser water
	e.6 (22)	Other_Controls (Reset Schedules)			Investigation looked for, but did not find this issue.	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Not Relevant	
	f.2 (24)	Pump Discharge Throttled	Finding 2 and 3	HWP-1 and HWP-2		HWP-1 and HWP-2
	f.3 (25)	Over-Pumping			Investigation looked for, but did not find this issue.	No valves are being overpumped.
	f.4 (26)	Equipment is oversized for load.			Investigation looked for, but did not find this issue.	Equipment is sized right for the intended use.
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Investigation looked for, but did not find this issue.	This building does not have this item.
	g.1 (28)	VFD Retrofit - Fans		AHU-1		Turn the constant volume AHU into a VAV system.

PBEEEP State Government

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11551 - MSU Moorhead/Bridges Hall

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps			Investigation looked for, but did not find this issue.	No payback for this item, building is small.
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	This building does not have this item.
	g.4 (31)	OTHER_VFD			Not Relevant	
h. Retrofits:	h.1 (32)	Retrofit - Motors			Investigation looked for, but did not find this issue.	Replace all motors with premium efficent motors once failed.
	h.2 (33)	Retrofit - Chillers			Not Relevant	Building gets chilled water from MacLean Hall. Chiller is only a couple of years old.
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Not Relevant	This building does not have this item.
	h.4 (35)	Retrofit - Boilers			Not Relevant	This building does not have this item.
	h.5 (36)	Retrofit - Packaged Gas fired heating			Not Relevant	This building does not have this item.
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	This building does not have this item.
	h.7 (38)	Retrofit - Equipment (custom)			Not Relevant	This building does not have this item.
	h.8 (39)	Retrofit - Pumping distribution method			Investigation looked for, but did not find this issue.	Pumps are lead/lag system with a heat exchanger.
	h.9 (40)	Retrofit - Energy/Heat Recovery			Not Relevant	This building does not have this item.
	h.10 (41)	Retrofit - System (custom)			Not Relevant	This building does not have this item.
	h.11 (42)	Retrofit - Efficient Lighting			Investigation looked for, but did not find this issue.	Building lights are T-8.
	h.12 (43)	Retrofit - Building Envelope			Investigation looked for, but did not find this issue.	Building shell is in decent order.
	h.13 (44)	Retrofit - Alternative Energy			Not Relevant	This building does not have this item.
	h.14 (45)	OTHER_Retrofit	Finding 9			Convert into a VAV system.
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard				Replace AHU1 and convert to a VAV system.
	i.2 (47)	Impurity/Contamination			Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper			Investigation looked for, but did not find this issue.	
	i.4 ( )	Leaky/Stuck Valve			Investigation looked for, but did not find this issue.	
	i.5 (48)	OTHER_Maintenance			Investigation looked for, but did not find this issue.	
j. OTHER	j.1 (49)	OTHER	items 1, 4, 5			insulation missing.

PBEEEP State Government

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11552 - MSU Moorhead/Ctr for Business

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive			Investigation looked for, but did not find this issue.	AHU1, AHU2, Pumps were reviewed and did not find issues.
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive			Investigation looked for, but did not find this issue.	
	a.3 (3)	Lighting is on more hours than necessary.			Investigation looked for, but did not find this issue.	
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Investigation looked for, but did not find this issue.	
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Investigation looked for, but did not find this issue.	AHU1 and AHU2 were reviewed and did not find issues.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.			Investigation looked for, but did not find this issue.	AHU1 and AHU2 were reviewed and did not find issues.
	b.3 (7)	OTHER_Economizer/OA Loads			Investigation looked for, but did not find this issue.	AHU1 and AHU2 were reviewed and did not find issues.
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive			Investigation looked for, but did not find this issue.	AHU1 and AHU2 were reviewed and did not find issues.
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement			Investigation looked for, but did not find this issue.	AHU1 and AHU2 were reviewed and did not find issues.
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	Finding 4			HX1 steam valve is hunting.
	c.4 (11)	OTHER_Controls			Not Relevant	
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Investigation looked for, but did not find this issue.	
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.			Investigation looked for, but did not find this issue.	
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently				AHU1 barely rotates or pushes any air.
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Not Relevant	no vfd on pumps
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Investigation looked for, but did not find this issue.	The AHU's run at slower speeds than for
	d.6 (17)	Other_Controls (Setpoint Changes)			Investigation looked for, but did not find this issue.	
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	The hw varies from 140 to 180 based on OAT.
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	Chilled water varies on OAT
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	The supply air modulates to maintain discharge air temps.
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	AHU 1 and 2 have extremely low setpoints and this is shown on the VFD speed.
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Not Relevant	Air cooled chiller
	e.6 (22)	Other_Controls (Reset Schedules)			Not Relevant	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Not Relevant	no daylight control.
	f.2 (24)	Pump Discharge Throttled	Finding 2 and 3			HWP-1 and 2 are throttled
	f.3 (25)	Over-Pumping			Investigation looked for, but did not find this issue.	Was unable to find evidence of over pumping.
	f.4 (26)	Equipment is oversized for load.			Investigation looked for, but did not find this issue.	The AHU appear to be over sized, but to replace when in good working order does nc
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Not Relevant	
	g.1 (28)	VFD Retrofit - Fans			Investigation looked for, but did not find this issue.	Both AHU's have VFD's

PBEEEP State Government

Rev. 2.0 (12/16/2010)

11552 - MSU Moorhead/Ctr for Business

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps			Not Relevant	no other VFD's present in this building.
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	
	g.4 (31)	OTHER_VFD			Not Relevant	
h. Retrofits:	h.1 (32)	Retrofit - Motors			Investigation looked for, but did not find this issue.	The motor once failed should be replaced with a premium efficent motor.
	h.2 (33)	Retrofit - Chillers			Investigation looked for, but did not find this issue.	Once the chiller has fail or close to failer, replace with a high efficient chiller.
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Not Relevant	There is no split system in this building.
	h.4 (35)	Retrofit - Boilers			Not Relevant	Building does not have this item.
	h.5 (36)	Retrofit - Packaged Gas fired heating			Not Relevant	Building does not have this item.
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	Building does not have this item.
	h.7 (38)	Retrofit - Equipment (custom)			Not Relevant	Building does not have this item.
	h.8 (39)	Retrofit - Pumping distribution method			Investigation looked for, but did not find this issue.	pumping system could be retro fitted to have a VFD. It doesn't have a payback.
	h.9 (40)	Retrofit - Energy/Heat Recovery			Not Relevant	Building does not have this item.
	h.10 (41)	Retrofit - System (custom)			Not Relevant	Building does not have this item.
	h.11 (42)	Retrofit - Efficient Lighting			Not Relevant	Building does not have this item.
	h.12 (43)	Retrofit - Building Envelope			Investigation looked for, but did not find this issue.	Did not find anything.
	h.13 (44)	Retrofit - Alternative Energy			Not Relevant	Building does not have this item.
	h.14 (45)	OTHER_Retrofit			Not Relevant	Building does not have this item.
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard			Not Relevant	
	i.2 (47)	Impurity/Contamination			Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper			Investigation looked for, but did not find this issue.	
	i.4 ( )	Leaky/Stuck Valve			Investigation looked for, but did not find this issue.	
	i.5 (48)	OTHER_Maintenance			Investigation looked for, but did not find this issue.	
j. OTHER	j.1 (49)	OTHER	Finding 1			

Investigation Checklist

PBEEEP State Government

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11553 - MSU Moorhead/Grier Hall

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	Finding 2	ahu 1		this building is vacant most of the time. The unit runs at scheduled times.
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive			Not Relevant	
	a.3 (3)	Lighting is on more hours than necessary.			Investigation looked for, but did not find this issue.	The building is unoccupied during the night. There are some lights are left on during
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Investigation looked for, but did not find this issue.	
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Investigation looked for, but did not find this issue.	
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	Finding 4			AHU 1 does have this.
	b.3 (7)	OTHER_Economizer/OA Loads			Investigation looked for, but did not find this issue.	
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive			Investigation looked for, but did not find this issue.	nothing was found on ahu-1
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement			Investigation looked for, but did not find this issue.	nothing was found on ahu-1
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints			Investigation looked for, but did not find this issue.	
	c.4 (11)	OTHER_Controls			Not Relevant	not relevant
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Not Relevant	
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	Finding 1 and 3	ahu1 and fcu's		
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently			Not Relevant	no vfd on fan
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Not Relevant	no pumps
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Not Relevant	no vav boxes
	d.6 (17)	Other_Controls (Setpoint Changes)			Investigation looked for, but did not find this issue.	
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Not Relevant	steam is used for heating.
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			Not Relevant	no chiller
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	the ahu 1 varies discharge air temp to maintain space temp.
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Not Relevant	no vfd on fan
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Not Relevant	no chiller
	e.6 (22)	Other_Controls (Reset Schedules)			Not Relevant	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Not Relevant	
	f.2 (24)	Pump Discharge Throttled			Not Relevant	no pumps
	f.3 (25)	Over-Pumping			Not Relevant	no pumps
	f.4 (26)	Equipment is oversized for load.			Investigation looked for, but did not find this issue.	
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Not Relevant	
	g.1 (28)	VFD Retrofit - Fans			Investigation looked for, but did not find this issue.	The fan does not run enough to justify further investigation.

PBEEEP State Government

Rev. 2.0 (12/16/2010)

11553 - MSU Moorhead/Grier Hall

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps			Not Relevant	no pumps
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	
	g.4 (31)	OTHER_VFD			Not Relevant	
h. Retrofits:	h.1 (32)	Retrofit - Motors				This motors are small and rarely used. Replace with motors with premium efficient motors once failed.
	h.2 (33)	Retrofit - Chillers			Not Relevant	
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Not Relevant	
	h.4 (35)	Retrofit - Boilers			Not Relevant	
	h.5 (36)	Retrofit - Packaged Gas fired heating			Not Relevant	
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	
	h.7 (38)	Retrofit - Equipment (custom)			Not Relevant	
	h.8 (39)	Retrofit - Pumping distribution method			Not Relevant	
	h.9 (40)	Retrofit - Energy/Heat Recovery			Not Relevant	
	h.10 (41)	Retrofit - System (custom)			Not Relevant	
	h.11 (42)	Retrofit - Efficient Lighting			Not Relevant	
	h.12 (43)	Retrofit - Building Envelope			Not Relevant	
	h.13 (44)	Retrofit - Alternative Energy			Not Relevant	
	h.14 (45)	OTHER_Retrofit			Investigation looked for, but did not find this issue.	Looked into turning into a VAV system, no payback
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard			Investigation looked for, but did not find this issue.	
	i.2 (47)	Impurity/Contamination			Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper			Investigation looked for, but did not find this issue.	
	i.4 ( )	Leaky/Stuck Valve			Investigation looked for, but did not find this issue.	
	i.5 (48)	OTHER_Maintenance			Investigation looked for, but did not find this issue.	
j. OTHER	j.1 (49)	OTHER			Investigation looked for, but did not find this issue.	

Investigation Checklist

PBEEEP State Government

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11554 - MSU Moorhead/Holmquist Hall

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive			Investigation looked for, but did not find this issue.	AHU-1 and 2 run 24 hours a day, they are scheduled off during holidays. The FCU run only when heat is needed.
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive			Investigation looked for, but did not find this issue.	
	a.3 (3)	Lighting is on more hours than necessary.			Not Relevant	This is a dorm
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Investigation looked for, but did not find this issue.	
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Investigation looked for, but did not find this issue.	the ahu's can not go into economizer, the units are MAU for the exhaust air.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.			Investigation looked for, but did not find this issue.	
	b.3 (7)	OTHER_Economizer/OA Loads			Not Relevant	The two ahu are MAU for the exhaust for the building
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive			Not Relevant	AHU's are heating only.
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement			Investigation looked for, but did not find this issue.	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	Finding 8, 9, 10			AHU-1 and AHU-2 and HX-1 steam valves hunt.
	c.4 (11)	OTHER_Controls			Not Relevant	
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Investigation looked for, but did not find this issue.	no daylighting controls
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	Finding 11, 13			The AHU's and FCU are over heating the spaces.
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently			Not Relevant	no vfd on fans.
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Not Relevant	no vfd on pumps
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Not Relevant	no vavs
	d.6 (17)	Other_Controls (Setpoint Changes)			Investigation looked for, but did not find this issue.	
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal				There is a reset schedule
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			Not Relevant	no chiller
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Not Relevant	AHU-1 are a single zone constant volume unit.
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Not Relevant	no vfd on fans.
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Not Relevant	No chiller
	e.6 (22)	Other_Controls (Reset Schedules)			Not Relevant	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Investigation looked for, but did not find this issue.	
	f.2 (24)	Pump Discharge Throttled	Finding 4, 5, 6, 7	HWP 1-4		Pumps 1-4 are overpumping, trimming the impelers was investigated.
	f.3 (25)	Over-Pumping			Investigation looked for, but did not find this issue.	could not find this issue
	f.4 (26)	Equipment is oversized for load.			Investigation looked for, but did not find this issue.	
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Investigation looked for, but did not find this issue.	
	g.1 (28)	VFD Retrofit - Fans			Investigation looked for, but did not find this issue.	The AHU's are the make up air for the bathroom and janitorial exhaust.

PBEEEP State Government

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11554 - MSU Moorhead/Holmquist Hall

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps			Investigation looked for, but did not find this issue.	Small pumps and major mechanical work would need to be completed for this to work.
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	
	g.4 (31)	OTHER_VFD			Not Relevant	
h. Retrofits:	h.1 (32)	Retrofit - Motors			Investigation looked for, but did not find this issue.	The motors are small, replace with premium efficient motors once these fail.
	h.2 (33)	Retrofit - Chillers			Not Relevant	
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Not Relevant	
	h.4 (35)	Retrofit - Boilers			Not Relevant	
	h.5 (36)	Retrofit - Packaged Gas fired heating			Not Relevant	
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	
	h.7 (38)	Retrofit - Equipment (custom)			Not Relevant	
	h.8 (39)	Retrofit - Pumping distribution method			Not Relevant	
	h.9 (40)	Retrofit - Energy/Heat Recovery			Not Relevant	
	h.10 (41)	Retrofit - System (custom)			Not Relevant	
	h.11 (42)	Retrofit - Efficient Lighting			Not Relevant	
	h.12 (43)	Retrofit - Building Envelope			Not Relevant	
	h.13 (44)	Retrofit - Alternative Energy			Not Relevant	
	h.14 (45)	OTHER_Retrofit			Not Relevant	
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard			Investigation looked for, but did not find this issue.	
	i.2 (47)	Impurity/Contamination_			Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper			Investigation looked for, but did not find this issue.	
	i.4 ( )	Leaky/Stuck Valve			Investigation looked for, but did not find this issue.	
	i.5 (48)	OTHER_Maintenance			Investigation looked for, but did not find this issue.	
j. OTHER	j.1 (49)	OTHER	find 2 and 3			condensate traps are possible failed.

Investigation Checklist

PBEEEP State Government

Rev. 2.0 (12/16/2010)

11555 - MSU Moorhead/King Hall

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive			Investigation looked for, but did not find this issue.	The ahu schedule follows the building schedule.
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive			Investigation looked for, but did not find this issue.	AHU's, Pumps, Chiller, HX are scheduled on/off according to schedule and OAT.
	a.3 (3)	Lighting is on more hours than necessary.			Investigation looked for, but did not find this issue.	
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Investigation looked for, but did not find this issue.	the ahu are on a schedule time of day consistant with occupancy.
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)	AHU1			AHU1 economizer is open until 40 degrees OAT
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	AHU1			
	b.3 (7)	OTHER_Economizer/OA Loads			Not Relevant	
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive			Investigation looked for, but did not find this issue.	The heating and cooling operate between 60 and 70 degrees.
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement			Investigation looked for, but did not find this issue.	The sensors are within calibration.
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints			Investigation looked for, but did not find this issue.	Was unable to find on any of the steam, heating water, or chilled water vavles
	c.4 (11)	OTHER_Controls			Not Relevant	
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Not Relevant	
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	The building setpoints			The building setpooints are 74 degrees
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently			Not Relevant	Constant volume systems
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	Pumps appear to modulate in an acceptable manner.
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Not Relevant	No vav boxes
	d.6 (17)	Other_Controls (Setpoint Changes)			Not Relevant	
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	Modulate from 130-200 on the OAT of 60-0.
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	When the Oat is 65 or lower the CHWS temp is 52 and when the OAT is 75 the CHV
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Not Relevant	
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Not Relevant	no vfd on the ahus
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Not Relevant	air cooled chiller
	e.6 (22)	Other_Controls (Reset Schedules)			Not Relevant	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Not Relevant	there are no daylighting controls
	f.2 (24)	Pump Discharge Throttled			Investigation looked for, but did not find this issue.	the pumps are no throttled.
	f.3 (25)	Over-Pumping			Investigation looked for, but did not find this issue.	could not find any evidence of this happening
	f.4 (26)	Equipment is oversized for load.			Investigation looked for, but did not find this issue.	
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Not Relevant	
	g.1 (28)	VFD Retrofit - Fans	Finding 5			

PBEEEP State Government

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11555 - MSU Moorhead/King Hall

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps			Investigation looked for, but did not find this issue.	pumps already have vfd.
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	
	g.4 (31)	OTHER_VFD			Not Relevant	
h. Retrofits:	h.1 (32)	Retrofit - Motors			Investigation looked for, but did not find this issue.	Replace the motors once failed with premium efficient motors.
	h.2 (33)	Retrofit - Chillers			Investigation looked for, but did not find this issue.	Chiller is new
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Not Relevant	
	h.4 (35)	Retrofit - Boilers			Not Relevant	
	h.5 (36)	Retrofit - Packaged Gas fired heating			Not Relevant	
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	
	h.7 (38)	Retrofit - Equipment (custom)			Not Relevant	
	h.8 (39)	Retrofit - Pumping distribution method			Not Relevant	
	h.9 (40)	Retrofit - Energy/Heat Recovery			Not Relevant	
	h.10 (41)	Retrofit - System (custom)			Not Relevant	
	h.11 (42)	Retrofit - Efficient Lighting			Investigation looked for, but did not find this issue.	
	h.12 (43)	Retrofit - Building Envelope			Not Relevant	
	h.13 (44)	Retrofit - Alternative Energy			Not Relevant	
	h.14 (45)	OTHER_Retrofit			Not Relevant	
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard			Investigation looked for, but did not find this issue.	
	i.2 (47)	Impurity/Contamination			Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper			Investigation looked for, but did not find this issue.	
	i.4 ( )	Leaky/Stuck Valve			Investigation looked for, but did not find this issue.	
	i.5 (48)	OTHER_Maintenance			Investigation looked for, but did not find this issue.	
j. OTHER	j.1 (49)	OTHER			Not Relevant	

Investigation Checklist

PBEEEP State Government

Rev. 2.0 (12/16/2010)

11558 - MSU Moorhead/Phys Plant

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive			Investigation looked for, but did not find this issue.	HV1, HV2, and S2 are scheduled on/off daily. S1 rarely runs, S3 doesn't run vary often.
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive				
	a.3 (3)	Lighting is on more hours than necessary.				
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Not Relevant	
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Investigation looked for, but did not find this issue.	HV1, HV2, S1 economizer is working.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.			Investigation looked for, but did not find this issue.	no issue was found.
	b.3 (7)	OTHER_Economizer/OA Loads			Not Relevant	
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive			Investigation looked for, but did not find this issue.	did not find an issue
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement			Investigation looked for, but did not find this issue.	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints			Investigation looked for, but did not find this issue.	
	c.4 (11)	OTHER_Controls				
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Not Relevant	
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	finding 2	S2		S2
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	no vfd's on the fans
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Not Relevant	no pumps
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Not Relevant	no vavs
	d.6 (17)	Other_Controls (Setpoint Changes)				
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Not Relevant	No heating water, just steam
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			Not Relevant	No chilled water, dx cooling
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Not Relevant	
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Not Relevant	No vfd to control duct static.
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Not Relevant	no condenser
	e.6 (22)	Other_Controls (Reset Schedules)			Not Relevant	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Not Relevant	
	f.2 (24)	Pump Discharge Throttled			Not Relevant	no pumps
	f.3 (25)	Over-Pumping			Not Relevant	no pumps
	f.4 (26)	Equipment is oversized for load.			Investigation looked for, but did not find this issue.	
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Investigation looked for, but did not find this issue.	Replace condensing units with high efficiency once they have failed.
	g.1 (28)	VFD Retrofit - Fans			Not Relevant	fans are to small to investigate vfd's

PBEEEP State Government

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11558 - MSU Moorhead/Phys Plant

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps			Not Relevant	no pumps
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	no process equipment
	g.4 (31)	OTHER_VFD			Not Relevant	
h. Retrofits:	h.1 (32)	Retrofit - Motors			Investigation looked for, but did not find this issue.	replace motors with premium efficient once they have failed.
	h.2 (33)	Retrofit - Chillers			Not Relevant	no chiller
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Not Relevant	
	h.4 (35)	Retrofit - Boilers			Not Relevant	no boilers
	h.5 (36)	Retrofit - Packaged Gas fired heating			Not Relevant	no gas fired equipment
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	
	h.7 (38)	Retrofit - Equipment (custom)			Not Relevant	
	h.8 (39)	Retrofit - Pumping distribution method			Not Relevant	
	h.9 (40)	Retrofit - Energy/Heat Recovery			Not Relevant	
	h.10 (41)	Retrofit - System (custom)			Not Relevant	
	h.11 (42)	Retrofit - Efficient Lighting			Investigation looked for, but did not find this issue.	
	h.12 (43)	Retrofit - Building Envelope			Investigation looked for, but did not find this issue.	
	h.13 (44)	Retrofit - Alternative Energy			Investigation looked for, but did not find this issue.	
	h.14 (45)	OTHER_Retrofit			Not Relevant	
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard				
	i.2 (47)	Impurity/Contamination			Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper				
	i.4 ( )	Leaky/Stuck Valve		finding 1 and 3		
	i.5 (48)	OTHER_Maintenance				
j. OTHER	j.1 (49)	OTHER				

PBEEEP State Government

Rev. 2.0 (12/16/2010)

11559 - MSU Moorhead/Murray Commons

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive			Investigation looked for, but did not find this issue.	The AHU's follow a reasonable schedule
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive			Investigation looked for, but did not find this issue.	
	a.3 (3)	Lighting is on more hours than necessary.			Investigation looked for, but did not find this issue.	
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Investigation looked for, but did not find this issue.	
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Investigation looked for, but did not find this issue.	Economizer controls to DAT.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.			Investigation looked for, but did not find this issue.	
	b.3 (7)	OTHER_Economizer/OA Loads			Investigation looked for, but did not find this issue.	
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive			Investigation looked for, but did not find this issue.	Looked into the trends, was unable to find this condition.
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement			Investigation looked for, but did not find this issue.	Sensors appear to be within calibration
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints			Investigation looked for, but did not find this issue.	the HX1 steam valve is hunting a little bit, changes by 5% every couple of minutes. I
	c.4 (11)	OTHER_Controls			Not Relevant	
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.				There is no current daylighting controls in this building.
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.		AC3, AC1, and AC2		AC1 and AC3 could use some setpont changes. AC2 was also looked at and found t
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	AC3 the fan speed varies.
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Not cost-effective to investigate	Small pumps with little use.
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Investigation looked for, but did not find this issue.	Could not find any issues.
	d.6 (17)	Other_Controls (Setpoint Changes)			Not Relevant	
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	HW reset is implemented.
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal	Chiller 1 supply water temperature is 42 degrees			Energy calcs have been preformed.
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	AHU1 modulates based on room temperature and AHU3 modulates based on discha
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Not Relevant	building does not contain liquid cooled chiller.
	e.6 (22)	Other_Controls (Reset Schedules)			Not Relevant	Building does not have this item.
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Not Relevant	
	f.2 (24)	Pump Discharge Throttled			Investigation looked for, but did not find this issue.	Triple duty valves are open.
	f.3 (25)	Over-Pumping			Investigation looked for, but did not find this issue.	
	f.4 (26)	Equipment is oversized for load.	Chiller 1 seams to oversized for current load.		Not cost-effective to investigate	From trend data the the maximum load seems to be around 30 tons for this building I
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Not Relevant	Building does not have this item.
	g.1 (28)	VFD Retrofit - Fans			Investigation looked for, but did not find this issue.	Possible to add VFD on AHU1 and AHU2. Not cost effective to look at, these units s

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11559 - MSU Moorhead/Murray Commons

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps			Investigation looked for, but did not find this issue.	2 of the HWP have 1 hp motors with VFD's, The other two HWP are 1 hp as welll and constant volume. The Chilled water pump is constant volume with a 7.5 hp motor.
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	Building does not have this item.
	g.4 (31)	OTHER_VFD			Not Relevant	Building does not have this item.
h. Retrofits:	h.1 (32)	Retrofit - Motors			Investigation looked for, but did not find this issue.	The motors in this building are small and the cost to replace working motors has no payback. If the motor fails replace with a premium efficient motor.
	h.2 (33)	Retrofit - Chillers			Investigation looked for, but did not find this issue.	The chiller is in good working condition and the efficiency isn't unacceptable.
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Not Relevant	Building does not have this item.
	h.4 (35)	Retrofit - Boilers			Not Relevant	Building does not have this item.
	h.5 (36)	Retrofit - Packaged Gas fired heating			Not Relevant	Building does not have this item.
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	Building does not have this item.
	h.7 (38)	Retrofit - Equipment (custom)			Not Relevant	Building does not have this item.
	h.8 (39)	Retrofit - Pumping distribution method			Not Relevant	Building does not have this item.
	h.9 (40)	Retrofit - Energy/Heat Recovery			Not Relevant	Building does not have this item.
	h.10 (41)	Retrofit - System (custom)			Not Relevant	Building does not have this item.
	h.11 (42)	Retrofit - Efficient Lighting			Not Relevant	Building does not have this item.
	h.12 (43)	Retrofit - Building Envelope			Investigation looked for, but did not find this issue.	Windows and doors look to be good shape. The windows could be replaced with mo
	h.13 (44)	Retrofit - Alternative Energy			Not Relevant	Building does not have this item.
	h.14 (45)	OTHER_Retrofit			Not Relevant	Building does not have this item.
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard			Investigation looked for, but did not find this issue.	
	i.2 (47)	Impurity/Contamination			Investigation looked for, but did not find this issue.	Did not find this issue.
	i.3 ( )	Leaky/Stuck Damper			Investigation looked for, but did not find this issue.	
	i.4 ( )	Leaky/Stuck Valve			Investigation looked for, but did not find this issue.	
	i.5 (48)	OTHER_Maintenance			Not Relevant	Building does not have this item.
j. OTHER	j.1 (49)	OTHER			Not Relevant	Building does not have this item.

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11560 - MSU Moorhead/Wellness Center

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	AHU'S are scheduled on at 5:30 am to 12 pm	Automation System		
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive		Automation System	Investigation looked for, but did not find this issue.	
	a.3 (3)	Lighting is on more hours than necessary.			Investigation looked for, but did not find this issue.	
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Investigation looked for, but did not find this issue.	
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)		Automation System	Investigation looked for, but did not find this issue.	
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.		Automation System	Investigation looked for, but did not find this issue.	
	b.3 (7)	OTHER_Economizer/OA Loads			Investigation looked for, but did not find this issue.	
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive	The heating pumps are off when the chilled water system is on. Chilled water system is allowed to turn on at 65 degrees and the heating system is 60 degrees.	Automation System	Investigation looked for, but did not find this issue.	
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement				
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints			Investigation looked for, but did not find this issue.	
	c.4 (11)	OTHER_Controls				
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Not Relevant	
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	unoccupied set points are 60 and 82	Automation System	Investigation looked for, but did not find this issue.	
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently				
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Investigation looked for, but did not find this issue.	
	d.6 (17)	Other_Controls (Setpoint Changes)			Not Relevant	
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal	Temperature reset is 150 degrees at OA of 60 and 190 degrees at OA of 0.	Automation System	Investigation looked for, but did not find this issue.	
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal	Temperature reset is 42 degrees at OA of 75 and 54 degrees at OA of 52.	Automation System	Investigation looked for, but did not find this issue.	
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal	Temperature reset is 55 degrees at OA of 60 and 65 degrees at OA of 0.	Automation System		AHU-2
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal		Automation System		
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Not Relevant	
	e.6 (22)	Other_Controls (Reset Schedules)			Not Relevant	
	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit				

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11560 - MSU Moorhead/Wellness Center

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
f. Equipment Efficiency Improvements / Load Reduction:	f.2 (24)	Pump Discharge Throttled			Investigation looked for, but did not find this issue.	
	f.3 (25)	Over-Pumping				
	f.4 (26)	Equipment is oversized for load.			Investigation looked for, but did not find this issue.	
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction				
g. Variable Frequency Drives (VFD):	g.1 (28)	VFD Retrofit - Fans			Not Relevant	
	g.2 (29)	VFD Retrofit - Pumps			Not Relevant	
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	
	g.4 (31)	OTHER_VFD			Not Relevant	
h. Retrofits:	h.1 (32)	Retrofit - Motors			Investigation looked for, but did not find this issue.	
	h.2 (33)	Retrofit - Chillers			Investigation looked for, but did not find this issue.	
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)	The electrical room has a split system. The temperature is set at 80 degrees.		Investigation looked for, but did not find this issue.	
	h.4 (35)	Retrofit - Boilers			Not Relevant	
	h.5 (36)	Retrofit - Packaged Gas fired heating			Not Relevant	
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	
	h.7 (38)	Retrofit - Equipment (custom)			Not Relevant	
	h.8 (39)	Retrofit - Pumping distribution method			Investigation looked for, but did not find this issue.	
	h.9 (40)	Retrofit - Energy/Heat Recovery			Not Relevant	
	h.10 (41)	Retrofit - System (custom)			Not Relevant	
	h.11 (42)	Retrofit - Efficient Lighting			Not Relevant	
	h.12 (43)	Retrofit - Building Envelope			Not Relevant	
	h.13 (44)	Retrofit - Alternative Energy			Not Relevant	
	h.14 (45)	OTHER_Retrofit			Not Relevant	
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard			Not Relevant	
	i.2 (47)	Impurity/Contamination			Not Relevant	
	i.3 ( )	Leaky/Stuck Damper			Not Relevant	
	i.4 ( )	Leaky/Stuck Valve			Not Relevant	
	i.5 (48)	OTHER_Maintenance			Not Relevant	
j. OTHER	j.1 (49)	OTHER			Not Relevant	

PBEEEP State Government

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11561 - MSU Moorhead/Center for the Arts

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	Finding 7, 8, 18, 19 ,20, 25			AHU1, AHU2, and AC2 run 24/7. S4 runs excessively.
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive			Investigation looked for, but did not find this issue.	
	a.3 (3)	Lighting is on more hours than necessary.			Investigation looked for, but did not find this issue.	no automated lighting
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Not Relevant	
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Investigation looked for, but did not find this issue.	
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.			Investigation looked for, but did not find this issue.	
	b.3 (7)	OTHER_Economizer/OA Loads	Finding 10, 21,			
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive				There are multiple multizone ahu and does have simultaneous heating and cooling.
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	Finding 22			
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	Finding 27			Heat exchanger 1-3 have this issue
	c.4 (11)	OTHER_Controls	Finding 11, 12, 15, 16, 17, 22, 23, 24, 26			Overheating and over cooling
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Investigation looked for, but did not find this issue.	There is no daylighting controls
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.			Investigation looked for, but did not find this issue.	The ahu do not turn on during unoccupied hours.
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently			Not Relevant	There are no fans with VFD's
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Not Relevant	There are no pumps with VFD's
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Not Relevant	There are no VAV boxes in this building
	d.6 (17)	Other_Controls (Setpoint Changes)			Investigation looked for, but did not find this issue.	
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	Heat exchangers vary the supply temp based on OAT
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			Not cost-effective to investigate	Was unable to obtain data on reset schedule for chilled water. We received this build
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	The heating air is constantly changing based on OAT or to maintain space temperatu
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	There are no
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Not cost-effective to investigate	we received this building after the cooling season and the information given to us did
	e.6 (22)	Other_Controls (Reset Schedules)			Investigation looked for, but did not find this issue.	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Not Relevant	Building does not have this item.
	f.2 (24)	Pump Discharge Throttled	Finding 3, 4, 5, 6			HWP 1, 2, 3, and 4 are throttled.
	f.3 (25)	Over-Pumping	Find 13			The chilled water pump is over pumping the valves.
	f.4 (26)	Equipment is oversized for load.			Investigation looked for, but did not find this issue.	
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Not Relevant	Building does not have this item.
	g.1 (28)	VFD Retrofit - Fans			Investigation looked for, but did not find this issue.	This is a

PBEEEP State Government

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11561 - MSU Moorhead/Center for the Arts

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps				Chilled water pump could have a VFD added to reduce overpumping of the valves.
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	Building does not have this item.
	g.4 (31)	OTHER_VFD			Not Relevant	Building does not have this item.
h. Retrofits:	h.1 (32)	Retrofit - Motors			Investigation looked for, but did not find this issue.	There is no payback for this item. Once motors have failed, then replace with a premium efficenct motor.
	h.2 (33)	Retrofit - Chillers			Investigation looked for, but did not find this issue.	The chiller is coming to the end of its useful life. This unit will have to be replaced in the next 10 years. Replace with a high efficent chiller once a replacement is needed.
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Not Relevant	There is a split system installed in the south penthouse. This serves the computer lab. The AC unit has acceptable efficiency.
	h.4 (35)	Retrofit - Boilers			Not Relevant	Building does not have this item.
	h.5 (36)	Retrofit - Packaged Gas fired heating			Not Relevant	Building does not have this item.
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	Building does not have this item.
	h.7 (38)	Retrofit - Equipment (custom)			Not Relevant	Building does not have this item.
	h.8 (39)	Retrofit - Pumping distribution method			Investigation looked for, but did not find this issue.	3 heat exchangers, two on the south side and one on the north side.
	h.9 (40)	Retrofit - Energy/Heat Recovery			Not Relevant	Building does not have this item.
	h.10 (41)	Retrofit - System (custom)			Not Relevant	Building does not have this item.
	h.11 (42)	Retrofit - Efficient Lighting			Not Relevant	Building does not have this item.
	h.12 (43)	Retrofit - Building Envelope			Not cost-effective to investigate	Windows are old and should be replaced but no payback.
	h.13 (44)	Retrofit - Alternative Energy			Not Relevant	Building does not have this item.
	h.14 (45)	OTHER_Retrofit			Not Relevant	Building does not have this item.
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard				
	i.2 (47)	Impurity/Contamination			Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper				There was a couple of dampers that needed to be replaced and where covered in the over heating and over cooling of the spaces.
	i.4 ( )	Leaky/Stuck Valve				Valves were being over pumped and until the over pumping issue is taken care of the full examination could not be completed.
	i.5 (48)	OTHER_Maintenance			Not Relevant	
j. OTHER	j.1 (49)	OTHER	Finding 1 and 2			condensate pumps are not insulated

Investigation Checklist

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11562 - MSU Moorhead/Hagen-Science

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	No		Investigation looked for, but did not find this issue.	Building is occupied 24/7
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	Yes	HWP's 1-4		Hot water pumps run continuously year round even when no heat is required.
	a.3 (3)	Lighting is on more hours than necessary.	No		Not Relevant	
	a.4 (4)	OTHER_Equipment Scheduling/Enabling	No			
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)	Yes	AHU's 1-5		OA Damper does not modulate. It is an Open/Closed Damper
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	No			
	b.3 (7)	OTHER_Economizer/OA Loads	No			
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive	Yes			On AHU-1 Only
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	No		Investigation looked for, but did not find this issue.	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	Yes	AHU 1		AHU 1 Cooling Valve
	c.4 (11)	OTHER_Controls	Yes			Setpoints are too high in winter / too cold in summer
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.	No		Not cost-effective to investigate	
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	Yes	Building Spaces		
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently	No		Investigation looked for, but did not find this issue.	
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently	Yes			HW pumps P 1-4 minimums are around 50%.
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary	No		Investigation looked for, but did not find this issue.	
	d.6 (17)	Other_Controls (Setpoint Changes)				
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal	No		Investigation looked for, but did not find this issue.	Energy saved by lowering reset schedule would be negated by increased pumping.
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal	No		Investigation looked for, but did not find this issue.	
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal	Yes			Sub cooling is seen during the summer season.
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal	No		Investigation looked for, but did not find this issue.	
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal	No		Investigation looked for, but did not find this issue.	
	e.6 (22)	Other_Controls (Reset Schedules)				
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit	No		Investigation looked for, but did not find this issue.	
	f.2 (24)	Pump Discharge Throttled	No		Investigation looked for, but did not find this issue.	
	f.3 (25)	Over-Pumping	No		Investigation looked for, but did not find this issue.	
	f.4 (26)	Equipment is oversized for load.	No		Investigation looked for, but did not find this issue.	
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction	No			
	g.1 (28)	VFD Retrofit - Fans	No		Not Relevant	

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11562 - MSU Moorhead/Hagen-Science

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps	No		Not Relevant	
	g.3 (30)	VFD Retrofit - Motors (process)	No		Not Relevant	
	g.4 (31)	OTHER_VFD	No		Not Relevant	
h. Retrofits:	h.1 (32)	Retrofit - Motors	No		Not Relevant	
	h.2 (33)	Retrofit - Chillers	No		Not Relevant	
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)	No		Not Relevant	
	h.4 (35)	Retrofit - Boilers	No		Not Relevant	
	h.5 (36)	Retrofit - Packaged Gas fired heating	No		Not Relevant	
	h.6 (37)	Retrofit - Heat Pumps	No		Not Relevant	
	h.7 (38)	Retrofit - Equipment (custom)	No		Not Relevant	
	h.8 (39)	Retrofit - Pumping distribution method	No		Not Relevant	
	h.9 (40)	Retrofit - Energy/Heat Recovery	No		Investigation looked for, but did not find this issue.	
	h.10 (41)	Retrofit - System (custom)	No		Not Relevant	
	h.11 (42)	Retrofit - Efficient Lighting	No		Not Relevant	
	h.12 (43)	Retrofit - Building Envelope	No		Not Relevant	
	h.13 (44)	Retrofit - Alternative Energy	No		Not Relevant	
	h.14 (45)	OTHER_Retrofit	No		Not Relevant	
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard	No		Investigation looked for, but did not find this issue.	
	i.2 (47)	Impurity/Contamination	No		Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper	No		Investigation looked for, but did not find this issue.	
	i.4 ( )	Leaky/Stuck Valve	No		Investigation looked for, but did not find this issue.	
	i.5 (48)	OTHER_Maintenance	No		Investigation looked for, but did not find this issue.	
j. OTHER	j.1 (49)	OTHER				

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11563 - MSU Moorhead/Heating Plant

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive			Investigation looked for, but did not find this issue.	
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive				
	a.3 (3)	Lighting is on more hours than necessary.			Investigation looked for, but did not find this issue.	
	a.4 (4)	OTHER_Equipment Scheduling/Enabling				
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Investigation looked for, but did not find this issue.	MAU is 100 percent outside air
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.			Investigation looked for, but did not find this issue.	MAU is 100 percent outside air
	b.3 (7)	OTHER_Economizer/OA Loads				
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive			Not Relevant	no cooling in this building except for the office.
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement				
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints				
	c.4 (11)	OTHER_Controls				
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Not Relevant	
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.				
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	Fan varies depending on number of operating boilers.
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Not Relevant	No pumps have a VFD currently.
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Not Relevant	no vav boxes
	d.6 (17)	Other_Controls (Setpoint Changes)			Not Relevant	
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Not Relevant	steam only in building
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			Not Relevant	no cooling
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal				
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	MAU varies speeds depending on number of boilers in operation.
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Not Relevant	no cooling
	e.6 (22)	Other_Controls (Reset Schedules)			Not Relevant	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Not Relevant	
	f.2 (24)	Pump Discharge Throttled			Not Relevant	
	f.3 (25)	Over-Pumping				
	f.4 (26)	Equipment is oversized for load.				
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction				
	g.1 (28)	VFD Retrofit - Fans			Investigation looked for, but did not find this issue.	MAU has a VFD

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11563 - MSU Moorhead/Heating Plant

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps				Feed water pumps 1-4
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	
	g.4 (31)	OTHER_VFD			Not Relevant	
h. Retrofits:	h.1 (32)	Retrofit - Motors				There is no payback on this item. Replace with premium efficient motors once they are failed.
	h.2 (33)	Retrofit - Chillers			Not Relevant	
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Not Relevant	
	h.4 (35)	Retrofit - Boilers				Boiler 4 should be replaced.
	h.5 (36)	Retrofit - Packaged Gas fired heating			Not Relevant	
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	
	h.7 (38)	Retrofit - Equipment (custom)			Not Relevant	
	h.8 (39)	Retrofit - Pumping distribution method			Not Relevant	
	h.9 (40)	Retrofit - Energy/Heat Recovery				Heat recovery from the flue gas on boiler 1
	h.10 (41)	Retrofit - System (custom)			Not Relevant	
	h.11 (42)	Retrofit - Efficient Lighting			Not Relevant	
	h.12 (43)	Retrofit - Building Envelope			Not Relevant	
	h.13 (44)	Retrofit - Alternative Energy				Heat recovery from the flue gas on boiler 1
	h.14 (45)	OTHER_Retrofit			Not Relevant	
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard				
	i.2 (47)	Impurity/Contamination				
	i.3 ( )	Leaky/Stuck Damper				
	i.4 ( )	Leaky/Stuck Valve				
	i.5 (48)	OTHER_Maintenance				
j. OTHER	j.1 (49)	OTHER				

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11564 - MSU Moorhead/MacLean Hall

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	AHU-2 running 24/7	AHU-2		AHU Run 24/7
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	AHU1 (7/17 - 7/22, 7/25 - 7/30)	AHU-1		AHU1 (7/17 - 7/22, 7/25 - 7/30)
	a.3 (3)	Lighting is on more hours than necessary.			Investigation looked for, but did not find this issue.	
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Investigation looked for, but did not find this issue.	night setbacks are set to 60°F
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Investigation looked for, but did not find this issue.	
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.			Investigation looked for, but did not find this issue.	
	b.3 (7)	OTHER_Economizer/OA Loads			Investigation looked for, but did not find this issue.	
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive			Investigation looked for, but did not find this issue.	
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement			Investigation looked for, but did not find this issue.	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	AHU1 Cooling Valve, AHU2 Heating Valve	AHU1 AHU-2		
	c.4 (11)	OTHER_Controls			Investigation looked for, but did not find this issue.	
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Investigation looked for, but did not find this issue.	
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.				
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary				
	d.6 (17)	Other_Controls (Setpoint Changes)			Investigation looked for, but did not find this issue.	
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal	CHWS Temp does not very			
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Not Relevant	
	e.6 (22)	Other_Controls (Reset Schedules)			Investigation looked for, but did not find this issue.	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Investigation looked for, but did not find this issue.	
	f.2 (24)	Pump Discharge Throttled			Investigation looked for, but did not find this issue.	
	f.3 (25)	Over-Pumping			Investigation looked for, but did not find this issue.	
	f.4 (26)	Equipment is oversized for load.			Investigation looked for, but did not find this issue.	
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Investigation looked for, but did not find this issue.	
	g.1 (28)	VFD Retrofit - Fans			Investigation looked for, but did not find this issue.	

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11564 - MSU Moorhead/MacLean Hall

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps			Investigation looked for, but did not find this issue.	
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	
	g.4 (31)	OTHER_VFD			Investigation looked for, but did not find this issue.	
h. Retrofits:	h.1 (32)	Retrofit - Motors			Investigation looked for, but did not find this issue.	
	h.2 (33)	Retrofit - Chillers			Investigation looked for, but did not find this issue.	
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Investigation looked for, but did not find this issue.	
	h.4 (35)	Retrofit - Boilers			Investigation looked for, but did not find this issue.	
	h.5 (36)	Retrofit - Packaged Gas fired heating			Investigation looked for, but did not find this issue.	
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	
	h.7 (38)	Retrofit - Equipment (custom)			Not Relevant	
	h.8 (39)	Retrofit - Pumping distribution method			Investigation looked for, but did not find this issue.	
	h.9 (40)	Retrofit - Energy/Heat Recovery			Investigation looked for, but did not find this issue.	
	h.10 (41)	Retrofit - System (custom)			Investigation looked for, but did not find this issue.	
	h.11 (42)	Retrofit - Efficient Lighting			Investigation looked for, but did not find this issue.	
	h.12 (43)	Retrofit - Building Envelope			Investigation looked for, but did not find this issue.	
	h.13 (44)	Retrofit - Alternative Energy			Investigation looked for, but did not find this issue.	
	h.14 (45)	OTHER_Retrofit			Investigation looked for, but did not find this issue.	
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard				
	i.2 (47)	Impurity/Contamination				
	i.3 ( )	Leaky/Stuck Damper				
	i.4 ( )	Leaky/Stuck Valve				
	i.5 (48)	OTHER_Maintenance				
j. OTHER	j.1 (49)	OTHER				

Deleted Findings Report

FWB Number: 11551 Eco #: 1 Building: Bridges Hall
Investigation Finding: CP-1 is uninsulated Equipment or System(s): Boiler Plant
Measure: Insulate the condensate tank. And save 6 therms

FWB Number:	11551 Eco #:	2	Building: Bridges Hall
Investigation Finding:	HWP-1 discharge is throttled	Equipment or System(s):	Pump, HW distribution
Measure:	Trim the impeller.		

FWB Number:	11551 Eco #:	3	Building: Bridges Hall
Investigation Finding:	HWP-2 discharge is throttled	Equipment or System(s):	Pump, HW distribution
Measure:	Trim the impeller.		

FWB Number:	11551 Eco #:	5	Building: Bridges Hall
Investigation Finding:	Uninsulated condensate piping	Equipment or System(s):	Boiler Plant
Measure:	Insulate the piping		

FWB Number:	11551 Eco #:	6	Building: Bridges Hall
Investigation Finding:	AHU1 Sensor Calibration.	Equipment or System(s):	AHU with heating and cooling
Measure:	Replace the temperature sensors on the hot deck, cold deck, and MAT.		

FWB Number:	11551 Eco #:	7	Building: Bridges Hall
Investigation Finding:	AHU1 over cooling and over heating the spaces.	Equipment or System(s):	AHU with heating and cooling
Measure:	Replace all the pneumatic thermostats with DDC thermostats.		

FWB Number:	11551 Eco #:	8	Building: Bridges Hall
Investigation Finding:	Retro fit the AHU to be VAV system	Equipment or System(s):	AHU with heating and cooling
Measure:	Replace dual duct with vav system.		

FWB Number:	11551 Eco #:	9	Building: Bridges Hall
Investigation	AHU1 cold deck	Equipment or	AHU with heating and

Finding:	reset	System(s):	cooling
Measure:	Reprogram the AHU to reset the discharge based on OAT.		

FWB Number:	11551	Eco #:	10	Building:	Bridges Hall
Investigation Finding:	AHU1 excessive simultaneous heating and cooling.		Equipment or System(s):	AHU with heating and cooling	
Measure:	Turn off the heating pumps and lock out the steam valves when the OAT is above 70 degrees.				

FWB Number:	11551	Eco #:	11	Building:	Bridges Hall
Investigation Finding:	HX 1 and 2 steam valves hunting		Equipment or System(s):	Boiler Plant	
Measure:	Tune the steam valve loop.				

FWB Number:	11552	Eco #:	1	Building:	Center for Business
Investigation Finding:	CP-1 is uninsulated		Equipment or System(s):	Boiler Plant	
Measure:	Insulate the condensate tank.				

FWB Number:	11552	Eco #:	3	Building:	Center for Business
Investigation Finding:	HWP-2 discharge is throttled		Equipment or System(s):	Pump, HW distribution	
Measure:	Trim the impeller.				

FWB Number:	11552	Eco #:	4	Building:	Center for Business
Investigation Finding:	Steam Valves HX1 is hunting		Equipment or System(s):	Boiler Plant	
Measure:	Tune the loop.				

FWB Number:	11552	Eco #:	5	Building:	Center for Business
Investigation Finding:	Combined measure 2 and 3		Equipment or System(s):	Pump, HW distribution	
Measure:	-				

FWB Number:	11552	Eco #:	6	Building:	Center for Business
Investigation Finding:	AH1 operates at extremely low VFD speeds.		Equipment or System(s):		AHU with heating and cooling
Measure:	-				

FWB Number:	11561	Eco #:	1	Building:	Center for the Arts
Investigation Finding:	CP-2 is uninsulated		Equipment or System(s):		Boiler Plant
Measure:	Insulate the condensate tank.				

FWB Number:	11561	Eco #:	2	Building:	Center for the Arts
Investigation Finding:	CP-3 is uninsulated		Equipment or System(s):		Boiler Plant
Measure:	Insulate the condensate tank.				

FWB Number:	11561	Eco #:	3	Building:	Center for the Arts
Investigation Finding:	HWP-1 discharge is throttled		Equipment or System(s):		Pump, HW distribution
Measure:	Trim the impeller.				

FWB Number:	11561	Eco #:	4	Building:	Center for the Arts
Investigation Finding:	HWP-2 discharge is throttled		Equipment or System(s):		Pump, HW distribution
Measure:	Trim the impeller.				

FWB Number:	11561	Eco #:	5	Building:	Center for the Arts
Investigation Finding:	HWP-3 discharge is throttled		Equipment or System(s):		Pump, HW distribution
Measure:	Trim the impeller.				

FWB Number:	11561	Eco #:	6	Building:	Center for the Arts
Investigation	HWP-4 discharge is		Equipment or		Pump, HW distribution

Finding:	throttled	System(s):	
Measure:	Trim the impeller.		

FWB Number:	11561	Eco #:	12	Building:	Center for the Arts
Investigation Finding:	Chilled Water Pump is over pumping control valves		Equipment or System(s):	Pump, primary CHW (evap-only)	
Measure:	Install a VFD on the Chilled water pump motor.				

FWB Number:	11561	Eco #:	20	Building:	Center for the Arts
Investigation Finding:	S-1 is over cooling and over heating the spaces.		Equipment or System(s):	AHU with heating and cooling	
Measure:	Replace Multizone actuators and thermostats				

FWB Number:	11561	Eco #:	21	Building:	Center for the Arts
Investigation Finding:	S-2 is over cooling and over heating the spaces.		Equipment or System(s):	AHU with heating and cooling	
Measure:	Replace Multizone actuators and thermostats				

FWB Number:	11561	Eco #:	22	Building:	Center for the Arts
Investigation Finding:	S-3 is over cooling and over heating the spaces.		Equipment or System(s):	AHU with heating and cooling	
Measure:	Replace Multizone actuators and thermostats				

FWB Number:	11561	Eco #:	25	Building:	Center for the Arts
Investigation Finding:	Steam Valves 1, 2, 3 are hunting.		Equipment or System(s):	Boiler Plant	
Measure:	Tune the loop.				

FWB Number:	11553	Eco #:	1	Building:	Grier Hall
Investigation Finding:	Set points not to State Standard		Equipment or System(s):	AHU with heating and cooling	
Measure:	Change Set points to 69 and 75 respectively				

FWB Number:	11553	Eco #:	3	Building:	Grier Hall
Investigation Finding:	FCU's 1 and 2 have setpoints of 72 degrees.		Equipment or System(s):	AHU with cooling only	
Measure:	Change set point to be 75 degrees.				

FWB Number:	11562	Eco #:	1	Building:	Hagen Hall
Investigation Finding:	CP-1 is uninsulated		Equipment or System(s):	Boiler Plant	
Measure:	Insulate the condensate tank.				

FWB Number:	11562	Eco #:	2	Building:	Hagen Hall
Investigation Finding:	No Economizer operation		Equipment or System(s):	AHU with heating and cooling	
Measure:	Modulate and control outside air damper for economizer operation.				

FWB Number:	11562	Eco #:	3	Building:	Hagen Hall
Investigation Finding:	Spaces are over-cooled during the summer.		Equipment or System(s):	VAV terminal unit	
Measure:	Reduce the VAV minimum supply CFM at VAV's with over-cooled spaces.				

FWB Number:	11562	Eco #:	4	Building:	Hagen Hall
Investigation Finding:	AHU-1 has simultaneous heating and cooling		Equipment or System(s):	AHU with heating and cooling	
Measure:	Lower heating system lockout setpoint to 60 deg F (currently 90 deg F).				

FWB Number:	11562	Eco #:	5	Building:	Hagen Hall
Investigation Finding:	AHU-1 cooling valve hunts		Equipment or System(s):	AHU with heating and cooling	
Measure:	Tune controls loop for AHU-1 cooling valve to eliminate cooling valve hunting.				

FWB Number:	11563	Eco #:	2	Building:	Heating Plant
Investigation Finding:	Boiler 1 feed water economizer		Equipment or System(s):	Boiler Plant	

Measure:	Install flue gas heat recovery				
FWB Number:	11563	Eco #:	3	Building:	Heating Plant
Investigation Finding:	Boiler 1 replace jackshaft burner controls		Equipment or System(s):		Boiler Plant
Measure:	Replace burner controls				
FWB Number:	11563	Eco #:	4	Building:	Heating Plant
Investigation Finding:	Boiler 2 replace jackshaft burner controls		Equipment or System(s):		Boiler Plant
Measure:	Replace burner controls				
FWB Number:	11563	Eco #:	5	Building:	Heating Plant
Investigation Finding:	Boiler 3 replace jackshaft burner controls		Equipment or System(s):		Boiler Plant
Measure:	Replace burner controls				
FWB Number:	11563	Eco #:	6	Building:	Heating Plant
Investigation Finding:	Replace boiler 4		Equipment or System(s):		Boiler Plant
Measure:	Replace boiler with high efficiency boiler				
FWB Number:	11563	Eco #:	7	Building:	Heating Plant
Investigation Finding:	Condensate return from campus		Equipment or System(s):		Boiler Plant
Measure:	Increase condensate return, reduce makeup water				
FWB Number:	11563	Eco #:	8	Building:	Heating Plant
Investigation Finding:	Boiler Feed Water Pump 1 motor replacement		Equipment or System(s):		Pump, other
Measure:	Replace the motor once failed with a premium efficient motor				
FWB Number:	11563	Eco #:	9	Building:	Heating Plant
Investigation Finding:	Boiler Feed Water Pump 2 motor replacement		Equipment or System(s):		Pump, other
Measure:	Replace the motor once failed with a premium efficient motor				

FWB Number:	11563	Eco #:	10	Building:	Heating Plant
Investigation Finding:	Boiler Feed Water Pump 3 motor replacement		Equipment or System(s):	Pump, other	
Measure:	Replace the motor once failed with a premium efficient motor				

FWB Number:	11563	Eco #:	11	Building:	Heating Plant
Investigation Finding:	Boiler Feed Water Pump 4 motor replacement		Equipment or System(s):	Pump, other	
Measure:	Replace the motor once failed with a premium efficient motor				

FWB Number:	11563	Eco #:	12	Building:	Heating Plant
Investigation Finding:	VFD on Boiler Feed Water Pump1		Equipment or System(s):	Pump, other	
Measure:	Install VFD on the Boiler Feed Water Pump				

FWB Number:	11563	Eco #:	13	Building:	Heating Plant
Investigation Finding:	VFD on Boiler Feed Water Pump2		Equipment or System(s):	Pump, other	
Measure:	Install VFD on the Boiler Feed Water Pump				

FWB Number:	11563	Eco #:	14	Building:	Heating Plant
Investigation Finding:	VFD on Boiler Feed Water Pump3		Equipment or System(s):	Pump, other	
Measure:	Install VFD on the Boiler Feed Water Pump				

FWB Number:	11563	Eco #:	15	Building:	Heating Plant
Investigation Finding:	VFD on Boiler Feed Water Pump4		Equipment or System(s):	Pump, other	
Measure:	Install VFD on the Boiler Feed Water Pump				

FWB Number:	11563	Eco #:	16	Building:	Heating Plant
Investigation Finding:	Condensate transfer pump 1 motor replacement		Equipment or System(s):	Pump, other	

Measure:	Replace the motor once failed with a premium efficient motor				
FWB Number:	11563	Eco #:	17	Building:	Heating Plant
Investigation Finding:	Condensate transfer pump 2 motor replacement		Equipment or System(s):	Pump, other	
Measure:	Replace the motor once failed with a premium efficient motor				
FWB Number:	11563	Eco #:	18	Building:	Heating Plant
Investigation Finding:	Combined measure 3, 4, 5		Equipment or System(s):	Boiler Plant	
Measure:	Replace burner controls. The submitted figures include post interaction factor savings of 12,785 therms for $68,315 Contractor Cost and $9315 PBEEEP Provider Cost. Simple payback equals 12.4 years.				
FWB Number:	11563	Eco #:	19	Building:	Heating Plant
Investigation Finding:	Combined measures 8, 9, 10, 11,16, and 17		Equipment or System(s):	Pump, other	
Measure:	Replace the motor once failed with a premium efficient motor				
FWB Number:	11563	Eco #:	20	Building:	Heating Plant
Investigation Finding:	Combined measures 12, 13, 14 and 15		Equipment or System(s):	Pump, other	
Measure:	Install VFD on the Boiler Feed Water Pump				

FWB Number:	11554	Eco #:	1	Building:	Holmquist Hall
Investigation Finding:	CP-2 is uninsulated		Equipment or System(s):	Boiler Plant	
Measure:	Insulate the condensate tank.				
FWB Number:	11554	Eco #:	6	Building:	Holmquist Hall
Investigation Finding:	HWP-1 is throttled.		Equipment or System(s):	Pump, HW distribution	
Measure:	Trim the impeller.				
FWB Number:	11554	Eco #:	7	Building:	Holmquist Hall
Investigation Finding:	HWP-2 is throttled.		Equipment or System(s):	Pump, HW distribution	
Measure:	Trim the impeller.				

FWB Number:	11554	Eco #:	8	Building:	Holmquist Hall
Investigation Finding:	HX-1 steam valve is hunting		Equipment or System(s):	Pump, HW distribution	
Measure:	Tune the loop				

FWB Number:	11554	Eco #:	9	Building:	Holmquist Hall
Investigation Finding:	AHU-1 is heating valve is hunting.		Equipment or System(s):	AHU with heating only	
Measure:	Tune the loop				

FWB Number:	11554	Eco #:	10	Building:	Holmquist Hall
Investigation Finding:	AHU-2 preheat and heating valves are hunting.		Equipment or System(s):	AHU with heating only	
Measure:	tune the loop.				

FWB Number:	11554	Eco #:	12	Building:	Holmquist Hall
Investigation Finding:	The FCU's are excessively heating the dorm rooms.		Equipment or System(s):	AHU with heating only	
Measure:	Install new pneumatic thermostats that are tamperproof.				

FWB Number:	11555	Eco #:	1	Building:	King Hall
Investigation Finding:	CP-1 is uninsulated		Equipment or System(s):	Boiler Plant	
Measure:	Insulate the condensate tank.				

FWB Number:	11555	Eco #:	4	Building:	King Hall
Investigation Finding:	Adjust the room setpoint		Equipment or System(s):	AHU with heating and cooling	
Measure:	Replace all the pneumatic thermostats with DDC thermostats.				

FWB Number:	11555	Eco #:	5	Building:	King Hall
Investigation Finding:	Retro fit the AHU to be VAV system		Equipment or System(s):	AHU with heating and cooling	
Measure:	Replace dual duct with vav system.				

FWB Number:	11555	Eco #:	6	Building:	King Hall
Investigation Finding:	AHU-2 Htg Valve Hunting		Equipment or System(s):	AHU with heating and cooling	
Measure:	Tune the heating valve loop.				

FWB Number:	11555	Eco #:	7	Building:	King Hall
Investigation Finding:	AHU-2 VFD doesn't modulate.		Equipment or System(s):	AHU with heating and cooling	
Measure:	Modulate the VFD speeds to control room temperature.				

FWB Number:	11555	Eco #:	8	Building:	King Hall
Investigation Finding:	Adjust the room setpoint AHU-2		Equipment or System(s):	AHU with heating and cooling	
Measure:	Adjust the space temperature from 75 - 69 degrees.				

FWB Number:	11564	Eco #:	1	Building:	MacLean Hall
Investigation Finding:	CP-1 is uninsulated		Equipment or System(s):	Boiler Plant	
Measure:	Insulate the condensate tank.				

FWB Number:	11564	Eco #:	3	Building:	MacLean Hall
Investigation Finding:	AHU-1 Cooling Valve Hunting		Equipment or System(s):	AHU with heating and cooling	
Measure:	Reprogram AHU-1 Cooling valve control loop to prevent the valve from hunting.				

FWB Number:	11564	Eco #:	5	Building:	MacLean Hall
Investigation Finding:	AHU-2 Hot Deck Heating Valve Hunts		Equipment or System(s):	AHU with heating and cooling	
Measure:	Reprogram AHU-2 Heating valve control loop to prevent the valve from hunting.				

FWB Number:	11558	Eco #:	2	Building:	Maintenance Building
Investigation Finding:	Condensate Pump is leaking steam and is uninsulated.		Equipment or System(s):	Other	

Measure:	Replace the condensate tank and pump assembly. It is nearing its expected life expectancy.

FWB Number:	11559	Eco #:	2	Building:	Murray Commons
Investigation Finding:	CP-1 is uninsulated	Equipment or System(s):	Boiler Plant		
Measure:	Insulate the condensate tank.				

FWB Number:	11559	Eco #:	3	Building:	Murray Commons
Investigation Finding:	CP-2 is uninsulated	Equipment or System(s):	Boiler Plant		
Measure:	Insulate the condensate tank.				

FWB Number:	11559	Eco #:	5	Building:	Murray Commons
Investigation Finding:	AC-1 cooling valve is failed	Equipment or System(s):	AHU with heating and cooling		
Measure:	Replace the chilled water valve and actuator.				

FWB Number:	11559	Eco #:	6	Building:	Murray Commons
Investigation Finding:	Chilled water supply temperature is a constant 42 degrees.	Equipment or System(s):	Chiller Plant		
Measure:	Reprogram the BAS system to reset the chilled water based on OAT.				

FWB Number:	11560	Eco #:	1	Building:	Wellness Center
Investigation Finding:	CP-1 is uninsulated	Equipment or System(s):	Boiler Plant		
Measure:	Insulate the condensate tank.				

FWB Number:	11560	Eco #:	6	Building:	Wellness Center
Investigation Finding:	AHU 1 cycles excessively at night	Equipment or System(s):	AHU with heating and cooling		
Measure:					

FWB Number:	11560	Eco #:	9	Building:	Wellness Center

Investigation Finding:	Lighting along east wall, day lighting sensor	Equipment or System(s):	Interior Lighting
Measure:	Install photo cell along east windows		

414 Nicollet Mall, GO-6
Minneapolis, MN 55401

1-800-481-4700
xcelenergy.com

October 14, 2011

Jeff Goebel
MSU Moorhead (phase 1)
1104 7th Ave S
Moorhead, MN 56563

Dear Jeff:

Thank you for participating in Xcel Energy's Recommissioning program. We have reviewed your study application and proposal and have preapproved your study. The following outlines your rebate and project information:

Building Address	1104 7th Ave S		
Study Cost	$142,941.00	Study Number	**RM1523**
Preapproved study rebate*	**$21,425.00**		

* Your rebate was based on the study cost provided. If the final study cost is lower, your rebate will be adjusted accordingly.

Study Provider	**Sebesta Blomberg**		
Account manager	**Mark Osendorf**	Phone	**320-255-8631**

Here's a quick review of the Recommissioning program process:

- Once your study is complete, your study provider will send a draft copy to us for review.
- After we complete our review and approve the study, we will send you a confirmation letter noting our approval.
- Your study provider will schedule a wrap-up meeting with you and your Xcel Energy account manager to go over the results of the study.
- You pay the study provider for the full cost of the study.
- You submit the Recommissioning Study Rebate Application, along with a copy of the invoice and your Customer Implementation Plan, to us within 3 months of your report presentation. Please work with your account manager to complete the Customer Implementation Plan.
- We'll send your study rebate check to you.

414 Nicollet Mall, GO-6
Minneapolis, MN 55401

1-800-481-4700
xcelenergy.com

Please note that we need to approve the final study in order to receive your study rebate.

This study pre-approval is valid for **3 months** from the date of this letter. If your study will take longer than that, please let us know. If you have any questions or comments, please call your assigned Xcel Energy account manager. Thanks again for participating in our Recommissioning program.

Sincerely,

Alex Birkholz
Marketing Assistant, Recommissioning

Attachment

CC: Mark Osendorf - Xcel Energy
Sherryl Volkert - Xcel Energy
Adam Bruns – Sebesta Blomberg

PBEEEP
State Government

Public Buildings Enhanced Energy Efficiency Program

SCREENING RESULTS FOR MINNESOTA STATE UNIVERSITY MOORHEAD

June 19, 2012

(For Final Investigation Report)

Campus Overview

Minnesota State University Moorhead	
Location	1104 7th Ave S Moorhead, MN 56563
Facility Manager	Jeff Goebel, Physical Plant Director
Number of Buildings	40
Interior Square Footage	1,725,190
PBEEEP Provider	Center for Energy and Environment
Date Visited	2/24/2010 – 2/25/2010
Facility Director	Jeff Goebel
Annual Energy Cost	$2,258,207 (from 2009 utility data)
Utility Company	Moorhead Public Service (electricity) Xcel Energy (natural gas)
Site Energy Use Index (EUI)	149 kBtu/sqft (from 2009 utility data)
Benchmark EUI (from B3)	128 kBtu/sqft

Minnesota State University (MSU) Moorhead is comprised of 40 buildings totaling 1,725,190 interior square feet. There are seven dormitory buildings, fourteen office and/or classroom buildings, a healthcare facility, a multifamily housing building, a field house, a student union, a mechanical building, a library and computing center, a maintenance shop, a laboratory, a dining facility, a storage building, and an exercise facility. All of the buildings are located on campus except for the Regional Science Center, which is in Glydon, Minnesota. There is a map of the campus showing the location of each building within the site at the end of this report.

Screening Overview

The goal of screening is to select buildings where an in-depth energy investigation can be performed to identify energy savings opportunities that will generate savings with a relatively short (1 to 5 years) and certain payback. The screening of MSU Moorhead was performed by the Center for Energy and Environment (CEE) with the assistance of the facility staff. A walk-through was conducted on February 24-25, 2010 and interviews with the facility staff were carried out to fully explore the status of the energy consuming equipment and their potential for recommissioning. This report is the result of that information.

Recommendation

Due to the large size of the campus, the campus has been divided into two groups of buildings for the investigation phase of the PBEEEP process. The energy investigation of the first group of buildings, Phase 1, is currently underway. The focus of this screening report is on the second group of buildings that are being recommended for investigation, Phase 2.

A detailed investigation of the energy usage and energy savings opportunities of the ten buildings listed below totaling 476,476 interior square feet at MSU Moorhead is recommended at this time. These buildings will be referred to as the "recommended buildings" throughout this report. The floor areas listed in the table have not been verified.

Building Name	State ID	Area (sq ft)	Year Built
Bridges Hall	E26072S1367	50,880	1967
Center for Business	E26072S1995	37,925	1995
Grier Hall	E26072S0232	7,028	1930
Holmquist Hall	E26072S5869	44,784	1965
King Hall	E26072S1470	40,874	1970
Livingston Lord Library	E26072S0860	125,073	1960
Lommen Hall	E26072S0332/ E26072S0157	71,093	1932
Maint. Bldg./Physical Plant	E26072S1966	21,700	1966
Murray Commons	E26072S5970	34,100	1970
Wellness Center	E26072S8505	43,019	2008

There are many factors that are part of the decision to recommend an energy investigation of a building; at MSU Moorhead some of the characteristics that were taken into account during the building selection process include:

- Potential energy savings opportunities observed during screening phase
- Large square footage
- Level of control by the building automation system
- Equipment size and quantity
- Frequency and severity of comfort and/or control issues
- Support from the staff and management to include building in an investigation

The following table lists the buildings that are part of the Phase 1 investigation currently underway:

Building Name	State ID	Area (sq ft)	Year Built
Center for the Arts	E267072S1266/E2672S1779	130,464	1966
Comstock Memorial Union	E26072S8067	89,739	1957
Flora Frick Hall	E26072S0532	30,962	1932
Grantham Hall	E26072S5030	45,411	1965
Hagen Hall	E26072S1063	92,435	1962
Heating Plant	E26072S0759	13,833	1959
Kise Commons	E26072S5462	28,621	1962
MacLean Hall	E26072S0632	93,407	1932
Nemzek Hall	E26072S1671	154,686	1959
Owens Hall	E26072S1570	30,810	1969
Science Laboratory	E26072S3504	87,000	2004
Weld Hall	E26072S0432	35,110	1916

The remaining buildings on campus that are not recommended for investigation are listed in the table below. Many of the buildings in this list are dormitories or residences, which have less potential for energy savings due to the 24/7 operation. The remainder of the buildings on the list are small, have low energy use, or limited equipment, thus making them less likely to have cost-effective energy saving potential.

Building Name	State ID	Area (Square Feet)	Year Built
Ballard Hall	E26072S5148	51,212	1948
Campus Security	E26072S3602	3,200	2000
Centennial House	Unknown	2,807	1936
Continuing Studies House	E26072S2226	2,682	1905
Dahl Hall	E26072S5258	76,040	1958
Delta Zeta House	E26072S3140	4,428	1940
Foundation Annex	Unknown	9,146	1940
Foundation House	Unknown	2,615	1949
Gateway Program House	E26072S2028	2,241	1928
Hendrix Health Center	E26072S0000	7,411	2003
John Neumaier Hall	Unknown	49,263	2002
Nelson Hall	E26072S5666	78,050	1966
Nemzek House	E26072S2328	2,850	1928
Regional Science Center	E26072S1892	13,000	1991
Snarr East	E26072S5564	39,000	1964
Snarr South	E26072S5767	38,050	1967
Snarr West	E26072S5362	31,112	1962
Unassigned House (1010 9th Ave S)	E26072S2740	3,129	1940

Recommended Buildings Descriptions

Details obtained through the screening process regarding the recommended buildings are included in the following:

Mechanical Equipment

The Heating Plant has four steam boilers that serve the entire campus, except for the Campus Security Building, the Foundation Annex, the Hendrix Health Center, John Neumaier Hall, and the Regional Science Center. The Heating plant was investigated in a previous project and is described here only because it supplies steam to each of the buildings to be included in the present investigation. Those buildings have their own boilers, forced air furnaces, or rooftop units that provide heating. Boilers #1-3 at the steam plant operate during the heating season and provide high-pressure steam at 65 to 85 psi. Boiler #4 operates from mid-May to Labor Day and provides low-pressure steam at around 12 psi. The steam from the Heating Plant is routed to the different buildings in underground tunnels and runs through heat exchangers located in each building. The heat exchangers transfer heat from the steam to water or glycol that is pumped to the air handlers, fin tube radiation and/or reheats in each building. There is not a central chilled water plant. There are thirteen chillers and three cooling towers located in individual buildings on the campus that serve eighteen buildings. Three buildings are cooled with window air conditioners, three buildings have residential forced air furnaces with "central air", four buildings have DX cooling, and two buildings have a combination of DX cooling and chilled water. Five buildings are not cooled.

The buildings were all constructed between 1905 and 2008. There have been major renovations to the mechanical systems in some of the buildings since they were constructed. Owens Hall has had VAV boxes added to the air handling system and Kise Commons and Lommen Hall were recently renovated. There have been major space use changes within the buildings as well. For example, Holmquist Hall was originally built and used as a dormitory, but currently is being used primarily as office space. The Center for the Arts had an open floor plan when built, but over the years rooms were closed off, leading to comfort issues due to unbalanced air flow to the spaces. These are examples of the changes that have been made to the mechanical systems and space uses; it is not a complete list. Due to the large size of the campus and the range in building ages, significant changes have been made to many of the buildings since they were constructed that cannot be completely documented here.

The following table lists the key mechanical equipment in the buildings recommended for investigation.

Mechanical Equipment Summary Table	
3	Building Automation Systems (Honeywell, Johnson Controls, Trane)
14	Buildings
878,529	Interior Square Feet
79	Air Handlers
281	VAV Boxes
124	Exhaust Fans and Power Roof Ventilators
53	Unit Heaters
3	Chillers
1	Cooling Tower
4	Steam Boilers (dual fuel- natural gas or fuel oil)
2	Hot Water Boilers
71	Pumps (HW, CHW, etc)
20	Heat Exchangers

Controls and Trending

Twenty-six of the buildings on campus are controlled by a Honeywell EBI R310.1 building automation system (BAS). Three of the buildings are controlled by a Johnson Controls Metasys BAS. There are eleven buildings that are not controlled by either BAS: the Campus Security Building, the Foundation Annex, the Hendrix Health Center, John Neumaier Hall, and seven small houses. Many of the buildings have pneumatic actuation and control; the building staff is in the process of switching some to direct digital control (DDC). Bridges Hall, King Hall, and the Center for Business are the most recent buildings to be switched to DDC. Murray Commons and Weld Hall are buildings that still have a significant amount of pneumatic actuation and control.

Lighting

Approximately 90% of interior lighting is T8s and there is a small fraction of T12s, T5s, incandescent, and metal halide. The majority of interior lighting is controlled by manual switches, around 20% are controlled by occupancy sensors, and around 8% have lighting controls.

The exterior lighting is primarily metal halide fixtures (85%) and the rest is high pressure sodium (15%) and incandescent and LED (<1%). All of the exterior lighting is controlled by photocell, except for a small fraction that is controlled by a time clock.

Energy Use Index and B3 Benchmark

The site Energy Use Index (EUI) is 149 kBtu/sqft, which is 16% higher than the B3 Benchmark of 128 kBtu/sqft. The median site EUI for State of Minnesota buildings are 23% lower than their corresponding B3 Benchmarks. This indicates that MSU Moorhead has the potential to further reduce its energy use.

Metering

There are ten electric meters, seventeen natural gas meters, and three fuel oil meters for the buildings located on campus. The Regional Science Center located off campus has four electric meters and one propane meter. The only individually metered buildings on campus are: the Foundation Annex, John Neumaier Hall, and seven small houses. These buildings each have one natural gas and one electric meter, except for John Neumaier Hall, which has only one electric meter.

Documentation

There is a significant amount of mechanical documentation, including building plans, equipment schedules, operations and maintenance manuals, balance reports, and control sequences, that are located in the Maintenance Building/Physical Plant. Although the plans are well organized, many of the buildings have had multiple renovations over the years and locating the most recent information for a given building can be difficult. Very little of the documentation is available in electronic form.

Building Summary Tables

The following tables are based on information gathered from interviews with facility staff, building walk-throughs, automation system screen-captures, and equipment documentation. The purpose of these tables is to provide the size and quantity of equipment and the level of control present in each building. It is complete and accurate to the best of our knowledge.

Bridges Hall State ID# E26072S1367					
Area (sqft)	50,880	Year Built	1967	Occupancy (hrs/yr)	4,680

HVAC Equipment

Description	**Type**	**Size**	**Notes**
BRIAH1	Multizone AHU with SF and RF	20,090 cfm 15 hp SF 7.5 hp RF	
BRIAH2	Constant Volume AHU with SF and RF	1,893 cfm 2 hp SF 1.5 hp RF	
BRIHX1 BRIHXER	Steam to Hot Water Converter		Serves AHUs
Pump #1 Pump #2	Constant Volume HWPs	3 hp and 2.2 hp	Circulate HW for BRIHX1
BRIHXER	Steam to Hot Water Converter		Serves perimeter radiation
Pump #1	Constant Volume HWP	3 hp	Circulates HW for BRIHXER
8 EFs	Exhaust Fans	¼ hp each	
FTR	Finned Tube Radiation		Along all exterior walls

Points on BAS

Description	**Points**
BRIAH1	RAT, RA RH, RF status, OA/RA/EA damper position, MAT, SF status, Cooling valve, Heating valve, Hot deck temp, Cold deck temp, Zone temps
BRIAH2	RAT, RA RH, RF status, OA/RA/EA damper position, MAT, SF status, Cooling valve, Heating valve, DAT, Room temp
Heating System	HW valve position, HWST, HWRT, Pump status

Additional Comments

- The facility staff reported that the equipment in this building was recently updated to DDC and the work was recommissioned.
- The facility staff are planning on installing VFD's on the supply and return fans of BRIAH1.
- This building uses chilled water from the MacLean Hall chiller and uses steam from the Heating Plant.

Center for Business State ID# E26072S1995					
Area (sqft)	37,925	Year Built	1995	Occupancy (hrs/yr)	4,680

HVAC Equipment

Description	Type	Size	Notes
CBAH 1	VAV AHU with SF and RF	20,085 cfm 25 hp SF 10 hp RF	Serves first floor
CBAH 2	VAV AHU with SF and RF	22,570 cfm 30 hp SF 20 hp RF	Serves second floor
53 VAV boxes	Variable Air Volume Boxes		
Chiller	Carrier Scroll Chiller	120 Tons	
CHW P1	Constant Volume CHWP	275 gpm 5 hp	
CBHX	Steam to Hot Water Converter	273 gpm	
Pump #1 Pump #2	Constant Volume HWPs	273 gpm each 7.5 hp each	Circulate HW for CBHX
FTR	Finned Tube Radiation		Along exterior walls

Points on BAS

Description	Points
CBAH 1 CBAH 2	RAT, RA RH, RF status, RF speed, OA/RA/EA damper position, MAT, Heating valve, Cooling valve, SF status, SF speed, DAT, Duct static pressure, Room temp
VAV boxes	Damper position, DAT, Heating valve, Space temp
Chiller	CHWST, Chiller status, CHW pump status, Compressor output
Heating System	HW valve position, HWST, Pump status

Additional Comments

- All of the pneumatic zone control was switched to DDC in summer 2010, except the converter control valve and the actuators on the AHUs are still pneumatic.
- This building uses steam from the Heating Plant.

Grier Hall State ID# E26072S0232					
Area (sqft)	7,028	Year Built	1930	Occupancy (hrs/yr)	4,680

HVAC Equipment

Description	Type	Size	Notes
GRIAH1	Constant Volume AHU with SF	3,000 cfm 1.5 hp SF	Face/bypass damper, serves entire building.
FTR	Finned Tube Radiation		Steam

Points on BAS

Description	Points
GRIAH1	RAT, OA/RA damper position, MAT, Face/Bypass damper position, Heating valve, Cooling valve, SF status, DAT

Additional Comments

- This building uses steam from the Heating Plant and chilled water from the Flora Frick chiller.

Holmquist Hall State ID# E26072S5869					
Area (sqft)	44,784	Year Built	1965	Occupancy (hrs/yr)	2,496

HVAC Equipment

Description	Type	Size	Notes
HOLAH 1	Constant Volume Multizone AHU with SF	4,750 cfm 3 hp SF	Serves East side of building.
HOLAH 2	Constant Volume Dual-Duct AHU with SF	4,750 cfm 3 hp SF	Serves West side of building
HX #1 HX #2	Steam to Hot Water Converters		
4 HW Pumps	Constant Volume HWPs	5 hp each	
150 FCUs	Fan Coil Units		

Points on BAS

Description	Points
HOLAH 1 HOLAH 2	OA damper position, PHeating valve, PH temp, SF status, Heating valve, DAT
Heating System	HW valve position, HWST, HWRT, Pump status

Additional Comments

- The building staff reported that this building was originally a dormitory but is now 35% dorm and 65% offices. There are plans to use the building for student housing again starting in Fall 2011.
- This building uses steam from the Heating Plant.

King Hall
State ID# E26072S1470

Area (sqft)	40,874	Year Built	1970	Occupancy (hrs/yr)	4,680

HVAC Equipment

Description	Type	Size	Notes
KINAC1	VAV AHU with SF	29,900 cfm 40 hp SF	Face/bypass, Dual-duct
KINAC2	VAV AHU with SF	6,000 cfm 10 hp SF	
Chiller	McQuay Chiller	170 Tons	Primary-secondary system. Also serves Owens Hall.
2 Secondary CHWPs	Variable Volume CHWPs	160 gpm for King Hall, 125 gpm for Owens Hall, 5 hp each	Serves Secondary loop, one circulates water to Owens Hall and one to King Hall.
KINHX1	Steam to Hot Water Converter		
Pump #1 Pump #2	Variable Volume HWPs	170 gpm each 5 hp each	Circulate HW for KINHX1
FTR	Finned Tube Radiation		

Points on BAS

Description	Points
KINAC1	RAT, OA/RA/EA damper position, MAT, PHeating valve, SF status, SF speed, Heating valve, Cooling valve, Cold deck temp, Hot deck temp, Zone temps
KINAC2	RAT, RA RH, RA/OA damper position, MAT, PHeating valve, PHST, PHRT, Temp in duct after PH, Heating valve, HWST, HWRT, Cooling valve, CHWST, CHWRT, SF status, SF speed, DAT, Humidity valve, Space temp
Cooling System	Chiller status, CHWST, CHWRT, CHW pump status, CHW pump speed, Primary loop pressure, Secondary loop pressure
Heating System	HW valve position, HWST, Pump status, Pump speed, Differential pressure

Additional Comments

- The building staff reported that the equipment was recently switched over to DDC.
- This building uses steam from the Heating Plant.

Livingston Lord Library State ID# E26072S0860					
Area (sqft)	125,073	Year Built	1960	Occupancy (hrs/yr)	5,824

HVAC Equipment

Description	Type	Size	Notes
LIVAHU1	Constant Volume AHU with SF and RF	35,900 cfm 25 hp SF 5 hp RF	
LIBAC1	Constant Volume AHU with SF and RF	31,500 cfm 20 hp SF 10 hp RF	
LIBAH1	Constant Volume AHU with SF	18,620 cfm 10 hp SF	Dual-duct, serves 4 zones
LIBAH2	Constant Volume AHU with SF and RF	26,390 cfm 15 hp SF 5 hp RF	Dual-duct, serves 6 zones
LIBAH3	Constant Volume AHU with SF	4,080 cfm 2 hp SF	Serves front study area
LIBAHLH	Constant Volume AHU with SF	3,120 cfm 3 hp SF	Face/bypass, serves Lecture Hall
Chiller	Trane Centrifugal Chiller	300 Tons	Water-cooled
Cooling Tower	Cooling Tower		
CHWP	Constant Volume CHWP	805 gpm 15 hp	
LIBHX1 LIBHX2 LIBHX3 LIBPHX	Steam to Hot Water Converters		Serve reheats, radiation, entry heaters, West Basement, East Basement, and West Penthouse.
2 East Basement HWPs	Constant Volume HWPs	137.5 gpm each 5 hp each	
2 West Penthouse HWPs	Constant Volume HWPs	190 gpm each 5 hp each	
3 West Basement HWPs	Constant Volume HWPs	1 x 337 gpm and 10 hp, 1 x 122 gpm and 1.5 hp, 1 x 98 gpm and 2 hp	
LIBUH1 LIBUH2	Unit Heaters		
FTR	Finned Tube Radiation		Hot Water

Points on BAS

Description	Points
LIVAHU1 LIBAC1	RF status, RAT, OA/RA/EA damper position, MAT, SF status, Cooling valve, Heating valve, DAT, Room temp
LIBAH1	RAT, RA RH, OA/RA damper position, MAT, SF status, Cooling valve, Heating valve, Cold deck temp, Hot deck temp, Humidity valve, Zone temp, Zone damper position, Room temp
LIBAH2	RF status, RAT, RA RH, OA/RA damper position, MAT, SF status, Cooling valve, Heating valve, Cold deck temp, Hot deck temp, Humidity valve, Zone temp, Zone damper position, Room temp
LIBAH3	RAT, OA/RA damper position, MAT, SF status, Cooling valve, Heating valve, DAT, Room temp
LIBAHLH	OA/RA damper position, MAT, Heating valve, SF status, DAT, Room temp
Cooling System	CHWST, CHWRT, CHW pump status, Chiller status, CDWST, CDWRT, CDW pump status
Heating System	HW valve position, HWST, HWRT, Pump status
UHs	Room temp, Heater status

Additional Comments

- The building staff reported that funding was requested to renovate this building in 2010 and it was denied. The likelihood of future renovation is unclear. They are waiting on a bonding bill for a capitol project… I'm guessing this means its still unclear.
- There is a substantial amount of pneumatic actuation in this building.
- This building uses steam from the Heating Plant.

Lommen Hall State ID# E26072S0332/ E26072S0157					
Area (sqft)	71,093	Year Built	1932	Occupancy (hrs/yr)	4,680

HVAC Equipment

Description	Type	Size	Notes
AHU-2-1	Constant Volume AHU	11,438 cfm 20 hp SF 10 hp RF	This AHU is constant volume and serves VAV boxes
AHU-B-1	Constant Volume AHU	21,070 cfm 30 hp SF 15 hp RF	
AHU-B-2	Constant Volume AHU	17,252 cfm 25 hp SF 15 hp RF	
AHU-B-3	Constant Volume AHU	8,683 cfm 15 hp SF 10 hp RF	This AHU is constant volume and serves VAV boxes
78 VAV boxes	Variable Air Volume Boxes		
2 Secondary CHWPs	Variable Volume CHWPs	445 gpm each 20 hp each	
2 Steam to HW HX	Steam to Hot Water Converters		
PBH-1 PBH-2	Variable Volume HWPs	145 gpm each 7.5 hp each	
PBH-3	Variable Volume HWPs	195 gpm 10 hp	
PBH-4	Variable Volume HWPs	202 gpm 10 hp	
FTR	Finned Tube Radiation		Hot water

Points on BAS

Description	Points

Additional Comments

- The building staff reported that this building recently underwent renovations, which were completed in December of 2010.
- This building uses chilled water from the Hagen/Science Lab chiller and steam from the Heating Plant.

Maintenance Building/Physical Plant State ID# E26072S1966					
Area (sqft)	21,700	Year Built	1966	Occupancy (hrs/yr)	3,510

HVAC Equipment

Description	Type	Size	Notes
MAIHV1	Constant Volume AHU with SF	4,000 cfm 1.5 hp SF	Face/bypass, DX cooling
MAIHV2	Constant Volume AHU with SF	1,000 cfm 1 hp SF	Face/bypass, DX cooling
MAIS1	Constant Volume AHU with SF	1,500 cfm 1.5 hp SF	Face/bypass
MAIS2	Constant Volume AHU with SF	3,525 cfm 1.5 hp SF	Face/bypass
MAIS3	Constant Volume AHU	3,525 cfm 1.5 hp SF	***This equipment is not on the BAS***
MAIS4	Constant Volume AHU	2,055 cfm 1.5 hp SF	***This equipment is not currently being used and is not on the BAS***
2 Condensate Pumps	Condensate Water Pumps	1 hp each	

Points on BAS

Description	Points
MAIHV1 MAIHV2	RAT, RA/OA damper position, MAT, Heating valve, Face/Bypass damper position, SF status, DX stage, DAT, Room temp, Reheat valve (MAIHV2 only)
MAIS1 MAIS2	OA/RA damper position, MAT, Heating valve, Face/Bypass damper position, SF status, DAT, Space temp

Additional Comments

- It was observed during screening that heat is not evenly distributed throughout the spaces during the winter.
- The building staff has reported that there is still a substantial amount of pneumatic actuation and control in the AHUs and converters.
- This building uses steam from the Heating Plant.

Murray Commons State ID# E26072S5970					
Area (sqft)	34,100	Year Built	1970	Occupancy (hrs/yr)	4,680

HVAC Equipment

Description	**Type**	**Size**	**Notes**
MURAC1	Constant Volume AHU with SF and RF	10,000 cfm 20 hp SF 7.5 hp SF	Face/bypass
MURAC2	Constant Volume AHU with SF	4,400 cfm 2 hp SF	Face/bypass
MURAC3	VAV AHU with SF and RF	9,295 cfm 20 hp SF 7.5 hp RF	Serves 17 VAV boxes
17 VAV boxes	Variable Air Volume Boxes		
Chiller	Trane Air-Cooled Chiller	80 Tons	
CHWP	Constant Volume CHWP	141 gpm 7.5 hp	
MURHX1 MURHX2	Steam to Hot Water Converters		
Pump #1 Pump #2	Constant Volume HWPs	1 hp each	Circulate HW for MURHX1
Pump #1 Pump #2	Variable Volume HWPs	1 hp each	Circulate HW for MURHX2
FTR	Finned Tube Radiation		Hot water

Points on BAS

Description	**Points**
MURAC1 MURAC2	RF status, RAT, RA RH, OA/RA/EA damper position, MAT, Heating valve, Face/Bypass damper position, Cooling valve, SF status, DAT, Room temp
MURAC3	RAT, RF status, RF speed, OA/RA/EA damper position, MAT, Heating valve, Cooling valve, SF status, SF speed, DAT, Duct static pressure
VAV Boxes	Supply air damper position, Room temp, Supply airflow, Reheat valve position
Cooling System	CHWST, CHWRT, Chiller status, CHW pump status
Heating System	HW valve position, HWST, HWRT, Pump status, Pump speed

Additional Comments

- The building staff reported that the equipment in this building still has a substantial amount of pneumatic actuation.
- This building uses steam from the Heating Plant.

Wellness Center State ID# E26072S8505					
Area (sqft)	43,019	Year Built	2008	Occupancy (hrs/yr)	6,188

HVAC Equipment

Description	**Type**	**Size**	**Notes**
AHU 1	Constant Volume AHU with SF and RF	13,883cfm 15 hp SF 15 hp RF	
AHU 2	VAV AHU with SF and RF	35,013 cfm 50 hp SF 20 hp RF	Serves 28 VAV boxes
28 VAV boxes	Variable Air Volume Boxes		HW reheat, ***this equipment is not on the BAS***
Chiller	York Air-Cooled Chiller	155 Tons	
CHWP-1 CHWP-2	Variable Volume CHWPs	275 gpm each 15 hp each	
HEX-1	Steam to Hot Water Converter		
HWP-3 HWP-4	Variable Volume HWPs	144 gpm each 5 hp each	
3 PRVs	Power Roof Ventilators	100 - 2,175 cfm 1/6 - 3/4 hp	
FTR	Finned Tube Radiation		Hot water

Points on BAS

Description	**Points**
AHU 1	RAT, RA RH, RF status, RA/OA damper position, MAT, CHWST, CHWRT, Cooling valve, HWST, HWRT, Heating valve, SF status, DAT, DA RH, Zone temp, Zone RH
AHU 2	RAT, RF status, RF speed, OA/RA/EA damper position, MAT, CHWST, CHWRT, Cooling valve, SF status, SF speed, DAT, DA duct static pressure, Coldest zone temp
Cooling System	Chiller status, CHWST, CHWRT, CHW differential pressure, CHW pump status, CHW pump speed, Compressor status
Heating System	Steam valve, HWST, HWRT, HW differential pressure, HW pump status, HW pump speed

Additional Comments

- According to the facility staff, there are plans to implement demand load limiting for the chiller.
- This building uses steam from the Heating Plant.

Center for the Arts			State ID # E26072S1266		
Area (sqft)	130,464	Year Built	1966	Occupancy (hrs/yr)	4,680
HVAC Equipment					

- **13 AHUs**

Name	Type	Size	Notes
CAAHU1	Constant Volume	20,090 cfm	CHW, HW
CAAHU2	Constant Volume	20,510 cfm	CHW, HW
CAAHU3	Constant Volume	8,850 cfm	CHW, HW
CAAHU4	Constant Volume	10,435 cfm	CHW, HW
CAS1	Constant Volume	18,000 cfm	Dual-duct, CHW, HW
CAS2	Constant Volume	18,000 cfm	Dual-duct, CHW, HW
CAS3	Constant Volume	12,000 cfm	Dual-duct, CHW, HW
CAS4	Constant Volume	5,000 cfm	CHW, HW
CAS5	Constant Volume	10,000 cfm	CHW, HW
CAS6	Constant Volume	4,600 cfm	
CAAC2	Constant Volume	4,843 cfm	Dual-duct with 3 zones, CHW, HW
CAAC3	Constant Volume	31,000 cfm	Dual-duct with 4 zones, CHW, HW
CAAC4	Constant Volume	8,081 cfm	Dual-duct with 3 zones, CHW, HW

- **1 Chiller with Cooling Tower**

Name	Type	Size	Notes
N/A	McQuay Centrifugal	300 Tons	Cooling tower fan has a VFD

- **5 Steam to HW Converters**
- **HW Fin Tube Radiation**
- **1 Mini-split System for Computer Rooms**
- **8 HW Pumps (all constant volume)**
- **1 CHW Pump (constant volume)**
- **1 CDW Pump (constant volume)**

Hagen Hall and Science Laboratory	State ID # E26072S1063/ E26072S3504

Area (sqft)	179,435	Year Built	1962/ 2004	Occupancy (hrs/yr)	4,680

HVAC Equipment

- **AHUs (AHUs 1-5 are supply fans that share one return fan, RAF 1)**

Name	Type	Size	Notes
AHU 1	VAV	26,500 cfm	VFD on SF, 100% OA, HW preheat, CHW, HW, glycol heat recovery
AHU 2	VAV	26,500 cfm	VFD on SF, 100% OA, HW preheat, CHW, HW, glycol heat recovery
AHU 3	VAV	26,500 cfm	VFD on SF, 100% OA, HW preheat, CHW, HW, glycol heat recovery
AHU 4	VAV	26,500 cfm	VFD on SF, 100% OA, HW preheat, CHW, HW, glycol heat recovery
AHU 5	VAV	26,500 cfm	VFD on SF, 100% OA, HW preheat, CHW, HW, glycol heat recovery
RAF 1	VAV	55,000 cfm	VFD on RF, serves AHUs 1-5
AHU 6	Constant Volume	5,000 cfm	100% OA, HW preheat, CHW, glycol heat recovery

- **5 Exhaust Fans**

Name	Type	Size	Notes
EF 1A	Constant Volume	18,667 cfm	Heat recovered from EA
EF 1B	Constant Volume	18,667 cfm	Heat recovered from EA
EF 1C	Constant Volume	18,667 cfm	Heat recovered from EA
EF 2	Constant Volume	4,300 cfm	
EF 3	VAV	40,000 cfm	Heat recovered from EA

- **2 Chillers with Cooling Tower**

Name	Type	Size	Notes
N/A	Centrifugal	550 Tons	Water-cooled chiller, primary-secondary system shared with 375 Ton chiller, primary loop is constant volume and secondary loop is variable volume.
N/A		375 Tons	Air-cooled, shares primary-secondary loop with 550 Ton chiller.

- **1 Electric Boiler**

Name	Type	Size	Notes
N/A	Electric	200 kW input, 682 pph output	Serves Science Lab, Used mid-May to Labor day when the campus runs on low-pressure steam.

- **2 Steam to HW Converters**
- **HW Fin Tube Radiation**
- **1 CDW Pump (constant volume)**
- **4 CHW Pumps (2 constant volume, 2 variable volume)**
- **4 HW Pumps (all variable volume)**

Points on BAS (Hagen Hall and Science Laboratory)

- **AHU 1-5 Points:** EA RH, Glycol temp, Heat recovery valve, Heat recovery supply temp, Heat recovery return temp, Heat recovery temp, OA damper position, RAT, Preheat valve, Preheat supply temp, Preheat return temp, CHWST, CHWRT, Cooling valve, HWRT, HWST, Heating valve, DA flow, SF status, SF speed, Humidifier valve, DA RH, DAT, DA static pressure
- **AHU 6 Points:** EA RH, EA flow, EF status, Glycol temp, Heat recovery valve, Heat recovery supply temp, Heat recovery return temp, Heat recovery temp, Preheat return temp, Preheat supply temp, Preheat valve, CHWRT, CHWST, Cooling valve, DA flow, DA RH, DAT
- **RAF 1 Points:** Duct static pressure, RA flow, RF status, RF speed
- **Cooling System Points:** Chiller status, Chiller 1 CHWST, Chiller 2 CHWST, Chiller 1 CHWRT, Chiller 2 CHWRT, CHWST, CHWRT, CHW primary pump status, Bypass valve position, CHW secondary pump status, CHW secondary pump speed, CHW differential pressure, CDWST, CDWRT, Cooling tower status, Cooling tower % output
- **Heating System Points:** Boiler status, Steam valve, HWST, HWRT, HW pump status, HW pump speed, HW differential pressure
- **EF 1A, 1B, 1C, and 2 Points:** Duct static pressure, Heat recovery inlet temp, Heat recovery outlet temp, EA flow, EF status
- **EF 3 Points:** Duct static pressure, Room exhaust humidity, Heat recovery inlet temp, Heat recovery outlet temp, EA flow, EF status, EF speed

Comments

- These buildings get steam from the Heating Plant.
- These buildings house classrooms and laboratory space.
- The equipment in these buildings is on the Johnson Controls BAS.

Heating Plant			State ID # E26072S0759		
Area (sqft)	13,833	Year Built	1959	Occupancy (hrs/yr)	8,760

HVAC Equipment

- **1 AHU**

Name	Type	Size	Notes
HTGAH1	Constant Volume	40,000 cfm	100% OA, steam, face/bypass, provides combustion air for boilers, VFD on fan adjusts speed based on number of operating boilers

- **4 Steam Boilers**

Name	Type	Size	Notes
Boiler 1	High Pressure Steam	61,500 pph	Used along with Boilers 2 and 3 during the winter, operate at 65-85 psi, no stack economizer, 9:1 turndown
Boiler 2	High Pressure Steam	40,000 pph	Stack economizer, 10:1 turndown
Boiler 3	High Pressure Steam	60,000 pph	Stack economizer, 6:1 turndown
Boiler 4	Low Pressure Steam	20,000 pph	Runs mid-May to Labor day, operates at 12psi

- **750 kW generator (hooked up to life safety systems)**
- **4 Fuel Oil Pumps**
- **6 Feedwater Pumps**
- **Steam Fin Tube Radiation**
- **3 Exhaust Fans**
- **2 Window A/C Units**
- **1 Split A/C Unit**

Points on BAS

- **HTAH1 Points:** Number of boilers running, VFD setpoint for each boiler, Heating valve, OA damper position, SF status, SF speed, DAT, Space temp
- **Boiler Points:** Steam flow (pph), 115 psi header pressure, Campus steam flow (kph), Natural gas usage total, Monthly total cubic feet of gas, Last month's total cubic feet of gas, Fuel oil usage totals per boiler, Fuel oil tank levels, Daily peak steam flow per boiler, Daily steam usage per boiler

Comments

- This building is on the Honeywell BAS.
- This building provides steam for the entire campus.
- Due to the boilers being high-pressure steam, they are monitored 24/7.
- All four boilers are dual-fuel; they can use natural gas or fuel oil. They have an O_2 analyzer and O_2 trim that changes settings depending on the fuel being used.

Kise Commons			**State ID # E26072S5462**		
Area (sqft)	28,621	Year Built	1962	Occupancy (hrs/yr)	5,824

HVAC Equipment

- **2 AHUs**

Name	**Type**	**Size**	**Notes**
AHU 1	Constant Volume	20,060 cfm	Multizone with 7 zones, CHW, HW
AHU 2	VAV	5,295 cfm	VFDs on SF and RF, CHW, serves VAV boxes

- **6 MAUs**

Name	**Type**	**Size**	**Notes**
MAU 1	Constant Volume	6,420 cfm	
MAU 2	Constant Volume	5,790 cfm	
MAU 3	Constant Volume	4,808 cfm	
MAU 4	Constant Volume	3,760 cfm	
MAU 5	Constant Volume	3,060 cfm	
MAU 6	Constant Volume	3,536 cfm	

- **12 VAV boxes with HW reheat**
- **1 Steam to HW Converter**
- **HW Fin Tube Radiation**
- **2 HW Pumps (both variable volume)**
- **1 HW Unit Heater**
- **1 Natural Gas Water Heater**

Points on BAS

- **AHU 1 Points:** RAT, MA/OA damper position, MAT, SF status, HWST, HWRT, Heating valve, CHWST, CHWRT, Cooling valve, Hot deck temp, Cold deck temp, Building pressure, Zone DAT, Zone damper position, Space temps
- **AHU 2 Points:** RAT, RF status, RF speed, EA/OA/MA damper position, MAT, CHWST, CHWRT, Cooling valve, SF status, SF speed, DAT, Duct static pressure
- **VAV Points:** Supply air flow, Damper position, Heating valve, Space temp
- **Heating System Points:** HW valve position, HWST, HWRT, Pump status, HW differential pressure
- **No MAU/PRV Points**

Comments

- This building gets steam from the Heating Plant and its chilled water from the Comstock Memorial Union chiller.
- This building houses a kitchen and dining hall.
- The equipment in this building is on the Honeywell BAS.
- This building has been renovated and commissioned recently, but the staff noted numerous comfort and control issues that remain.

MacLean Hall			State ID # E26072S0632		
Area (sqft)	93,407	Year Built	1932	Occupancy (hrs/yr)	4,680

HVAC Equipment

- **2 AHUs**

Name	Type	Size	Notes
AHU 1	VAV	59,729 cfm	This AHU has a fan wall of 12 SFs, 11 RFs, and 1 EF, 1 VFD for all SFs and 1 VFD for all RFs, CHW, HW, heat recovery between EA and OA, serves VAV boxes
AHU 2	Constant Volume	11,165 cfm	HW and DX cooling, Dual-duct, 6 zones

- **1 Chiller**

Name	Type	Size	Notes
N/A	Aeon	275 Tons	Chiller serves MacLean and Bridges Hall

- **1 DX Unit**

Name	Type	Size	Notes
N/A	Unknown	30 Tons	Serves AHU 2

- **67 VAV boxes with HW reheat**
- **1 Steam to HW Converter**
- **HW Fin Tube Radiation**
- **2 HW Pumps (both variable volume)**
- **3 CHW Pumps (1 constant volume primary, 2 variable volume secondary)**

Points on BAS

- **AHU 1 Points:** RAT, RA RH, RF status, RF speed, EA/OA/MA damper position, EF speed, EF status, OA temp after heat recovery, MAT, Cooling valve, Heating valve, SF status, SF speed, Duct static pressure, Heat wheel status
- **AHU 2 Points:** RAT, RA RH, OA/EA/MA damper position, MAT, SF status, DX stage, Cold deck temp, Hot deck temp, DA humidity, Zone damper position, Space temp
- **Cooling System Points:** Chiller status, Secondary CHW pump status, Secondary CHW pump speed, CHWST, CHWRT, CHW differential pressure, Bridges CHW pump speed and status
- **Heating System Points:** Steam valve position, HWST, HWRT, Pump status, HW differential pressure

Comments

- This building gets steam from the Heating Plant.
- This building houses classrooms and offices.
- The equipment in this building is on the Honeywell BAS.

Area (sqft)	89,739	Year Built	1957	Occupancy (hrs/yr)	5,824

HVAC Equipment

- **AHUs**

Name	Type	Size	Notes
CMUAH1	Constant Volume	4,460 cfm	CHW, HW
CMUAHU1	VAV	18,016 cfm	VFDs on SF and RF, CHW, HW, serves 6 VAV boxes with reheat
CUAH2	VAV	17,015 cfm	VFDs on SF and RF, CHW, HW, serves VAV boxes
CUAH3	VAV	12,755 cfm	VFDs on SF and RF, CHW, HW, serves VAV boxes
CUAH4	Constant Volume	4,040 cfm	CHW, HW
CUAH6	VAV	5,415 cfm	VFDs on SF and RF, CHW, HW, serves VAV boxes
CUAH7	VAV	14,950 cfm	VFDs on SF and RF, CHW, HW, serves VAV boxes
CUAH8	VAV	15,220 cfm	VFDs on SF and RF, CHW, HW, serves VAV boxes
CMUAH9	VAV	11,165 cfm	100% OA, VFD on SF, CHW, HW
CMUAH10	Constant Volume	1,447 cfm	100% OA, HW
CMUAH11	Constant Volume	6,240 cfm	CHW, HW

- **74 VAV boxes some with HW reheat**

- **2 Chillers**

Name	Type	Size	Notes
N/A	Trane	400 Tons	Serves Comstock Memorial Union and Kise Commons
N/A	Carrier	70 Tons	Serves CMU ballroom

- **4 Steam to HW Converters**

- **HW Fin Tube Radiation**

- **8 HW Pumps (6 constant volume, 2 variable volume)**

- **3 CHW Pumps (all constant volume)**

Points on BAS (Comstock Memorial Union)
• **CMUAH1,5 Points:** RA RH, RF status, OA/MA/EA damper position, MAT, Heating valve, Cooling valve, SF status, DAT, Space temp • **CMUAHU1 Points:** RF status, RF speed, RAT, OA/MA/EA dampers, MAT, SF status, SF speed, Cooling valve, Heating valve, DAT, Duct static pressure, RA velocity pressure, RA CO2 • **CUAH2-4,6-8 Points:** RAT, RF status, RF speed, OA/MA/EA damper position, MAT, Heating valve, Cooling valve, SF status, SF speed, DAT, DA RH, Duct static pressure, Room RH, Room temp • **CMUAH9 Points:** Heating valve, Cooling valve, SF status, SF speed, DAT, Space temp, DA airflow • **CMUUG Points:** MA/OA damper position, MAT, Cooling valve, Heating valve, SF status, DAT, Space temp • **CMUAH10 Points:** Heating valve, SF status, DAT • **Cooling System Points:** CHWST, CHWRT, Chiller status, Chiller flow, Pump status • **Heating System Points:** HW valve position, HWST, HWRT, Pump status, Pump speed (Cooling valve pumps only), Differential pressure • **VAV Points:** Supply air damper position, Space temperature, Supply air flow, Controller status mode
Comments
• This building gets steam from the Heating Plant. • This building is a student union. • This building is on the Honeywell BAS.

Flora Frick Hall			State ID # E26072S0532		
Area (sqft)	30,962	Year Built	1932	Occupancy (hrs/yr)	4,680

HVAC Equipment

- **2 AHUs**

Name	Type	Size	Notes
FRIAH1	VAV	22,750 cfm	VFDs on SF and RF, CHW, HW, serves VAV boxes
FRIAH2	Constant Volume	6,840 cfm	CHW, HW

- **34 VAV boxes with HW reheat**

- **1 Chiller**

Name	Type	Size	Notes
N/A		80 Tons	Serves Flora Frick Hall and Grier Hall

- **1 Steam to HW Converters**
- **6 HW Pumps (all constant volume)**
- **1 CHW Pump (constant volume)**
- **3 Exhaust Fans**

Points on BAS

- **FRIAH1 Points:** RA CO2, RAT, RF status, RF speed, OA/MA/EA damper position, MAT, Heating valve, Cooling valve, SF status, Duct static setpoint
- **FRIAH2 Points:** RA RH, RAT, SF status, OA/MA/EA damper position, MAT, Heating valve, Cooling valve, SF status, DAT, Humidity valve, Space temps
- **EF Points:** EF status
- **VAV Points:** Damper position, Space temperature, Supply air flow, Reheat valve position
- **Cooling System Points:** Chiller status, CHWRT, CHWST, Pump status, Chiller temp reset
- **Heating System Points:** HW valve position, HWRT, HWST, Pump status

Comments

- This building gets steam from the Heating Plant.
- This building houses classrooms, offices, and a computer center.
- This building is on the Honeywell BAS.

Grantham Hall			State ID # E26072S5030		
Area (sqft)	45,411	Year Built	1965	Occupancy (hrs/yr)	6,552

HVAC Equipment

- **2 AHUs**

Name	Type	Size	Notes
GRAAH1	Constant Volume	6,500 cfm	2-stage DX cooling
GRAAH2	Constant Volume	9,000 cfm	100% OA, HW

- **100-200 Fan Coil Units**
- **1 DX Unit**

Name	Type	Size	Notes
N/A	Air-cooled split system	16 Tons	Serves GRAAH1

- **2 Steam to HW Converters**
- **5 HW Pumps (all constant volume)**
- **HW Fin Tube Radiation**

Points on BAS

- **GRAAH1 Points:** RAT, OA/MA/EA damper position, MAT, DX stage, SF status, DAT
- **GRAAH2 Points:** Heating valve, SF status, DAT
- **HX and Pump Points:** HW valve position, HWST, Pump status

Comments

- This building gets steam from the Heating Plant.
- This building is a dormitory.
- This building is on the Honeywell BAS.

Kise Commons			State ID # E26072S5462		
Area (sqft)	28,621	Year Built	1962	Occupancy (hrs/yr)	5,824

HVAC Equipment

- **2 AHUs**

Name	Type	Size	Notes
AHU 1	Constant Volume	20,060 cfm	Multizone with 7 zones, CHW, HW
AHU 2	VAV	5,295 cfm	VFDs on SF and RF, CHW, serves VAV boxes

- **6 MAUs**

Name	Type	Size	Notes
MAU 1	Constant Volume	6,420 cfm	
MAU 2	Constant Volume	5,790 cfm	
MAU 3	Constant Volume	4,808 cfm	
MAU 4	Constant Volume	3,760 cfm	
MAU 5	Constant Volume	3,060 cfm	
MAU 6	Constant Volume	3,536 cfm	

- **12 VAV boxes with HW reheat**
- **1 Steam to HW Converter**
- **HW Fin Tube Radiation**
- **2 HW Pumps (both variable volume)**
- **1 HW Unit Heater**
- **1 Natural Gas Water Heater**

Points on BAS

- **AHU 1 Points:** RAT, MA/OA damper position, MAT, SF status, HWST, HWRT, Heating valve, CHWST, CHWRT, Cooling valve, Hot deck temp, Cold deck temp, Building pressure, Zone DAT, Zone damper position, Space temps
- **AHU 2 Points:** RAT, RF status, RF speed, EA/OA/MA damper position, MAT, CHWST, CHWRT, Cooling valve, SF status, SF speed, DAT, Duct static pressure
- **VAV Points:** Supply air flow, Damper position, Heating valve, Space temp
- **Heating System Points:** HW valve position, HWST, HWRT, Pump status, HW differential pressure
- **No MAU/PRV Points**

Comments

- This building gets steam from the Heating Plant and its chilled water from the Comstock Memorial Union chiller.
- This building houses a kitchen and dining hall.
- The equipment in this building is on the Honeywell BAS.
- This building has been renovated and commissioned recently, but the staff noted numerous comfort and control issues that remain.

Nemzek Hall			State ID # E26072S1671		
Area (sqft)	154,686	Year Built	1959	Occupancy (hrs/yr)	6,570

HVAC Equipment

- **18 AHUs**

Name	Type	Size	Notes
NEMAHU1	Constant Volume	48,000 cfm	HW only
NEMAHU2	Constant Volume	48,000 cfm	HW only
NEMAHU3	Constant Volume	15,500 cfm	CHW and HW
NEMAHU4	Constant Volume	6,300 cfm	CHW and HW
NEMAHU5	Constant Volume	9,750 cfm	CHW and HW
NEMAHU6	Constant Volume	9,000 cfm	CHW, HW, Dual-duct, 2 zones
NEMAHU7	Constant Volume	4,850 cfm	CHW and HW
NEMAHU8	Constant Volume	6,600 cfm	CHW, HW, Dual-duct, 2 zones
NEMAHU9	Constant Volume	2,200 cfm	CHW and HW
NEMAHU10	Constant Volume	9,455 cfm	CHW and HW
NEMAHU11	Constant Volume	3,000 cfm	
NEMAHU12	Constant Volume	3,000 cfm	
NEMAH1	Constant Volume	1,080 cfm	HW only, Face/Bypass
NEMAH2	Constant Volume	1,080 cfm	HW only, Face/Bypass
NEMAH3	Constant Volume	1,080 cfm	HW only, Face/Bypass
NEMAH4	Constant Volume	1,800 cfm	HW only
NEMVU4	Constant Volume	22,800 cfm	HW only
NEMFC1	Constant Volume	600 cfm	HW only

- **1 Chiller**

Name	Type	Size	Notes
N/A	Trane	185 Tons	

- **1 Dectron Pool unit**
- **2 RTUs (start/stop control on BAS only, both have DX cooling and electric heat)**
- **HW Fin Tube Radiation**
- **6 Steam to HW Converters (one serves the pool)**
- **11 HW Pumps (all constant volume)**
- **1 CHW Pump (constant volume)**

Points on BAS (Nemzek Hall)
• **NEMAH1-3 Points:** RAT, OA/MA damper position, MAT, Heating valve, Face/Bypass damper position, SF status, DAT • **NEMAH4, NEMAHU1,2, NEMVU4 Points:** RAT, OA/MA damper position, MAT, Heating valve, SF status, DAT, Space temp • **NEMAHU3-5,7,9,10 Points:** RAT, RA RH, OA/MA damper position, MAT, SF status, Cooling valve, Heating valve, DAT, Space temp • **NEMAHU6,8 Points:** RA RH, RAT, MA/OA damper position, MAT, SF status, Cooling valve, Heating valve, Cold deck temp, Hot deck temp, Zone damper position, Zone temp • **NEMFC1 Points:** RAT, OA/MA damper position, MAT, Heating valve, SF status, DAT, Space temp • **Cooling System Points:** CHWST, CHWRT, Chiller status, CHW pump status • **Heating System Points:** HW valve position, HWST, HWRT, Pump status
Comments
• This building gets steam from the Heating Plant. • This building houses gymnasiums, courts, classrooms, and offices. • The equipment in this building is on the Honeywell BAS. • RTUs and pool AHU are not on DDC. • The pool AHU does not provide enough outside air, so a packaged unit may be added to supplement. • RTU that serves the office area on the south side of the building doesn't have enough electric resistance heat so the space becomes cold during the winter.

Owens Hall			State ID # E26072S1570		
Area (sqft)	30,810	Year Built	1969	Occupancy (hrs/yr)	3,861

HVAC Equipment

- **1 AHU**

Name	Type	Size	Notes
OWES1	Constant Volume	26,000 cfm	Multizone, CHW, HW, 11 zones, VAV boxes added to some of the zones

- **11 VAV boxes with HW reheat**
- **1 Steam to HW Converter**
- **4 HW Pumps (all constant volume)**
- **HW Fin Tube Radiation**

Points on BAS

- **OWES1 Points:** RAT, RA RH, OA/MA/EA damper position, MAT, SF status, Cooling valve, Heating valve, Cold deck temp, Hot deck temp, Space temp
- **Heating System Points:** HW valve position, HWST, HW pump status, Fin tube radiation valve

Comments

- This building gets steam from the Heating Plant and its chilled water from King Hall.
- This building houses offices.
- The equipment in this building is on the Honeywell BAS.
- This building has a lot of comfort complaints because VAV boxes were added to OWES1 but the supply fan is constant volume.

Weld Hall			State ID # E26072S0432		
Area (sqft)	35,110	Year Built	1916	Occupancy (hrs/yr)	4,680

HVAC Equipment

- **3 AHUs**

Name	Type	Size	Notes
WELAH1	Constant Volume	23,000 cfm	CHW, steam, Dual-duct, 3 zones
WELAH2	Constant Volume	5,615 cfm	DX cooling, steam, Dual-duct, 2 zones
WELAH3	Constant Volume	12,000 cfm	CHW, steam, Face/Bypass

- **1 DX unit**

Name	Type	Size	Notes
N/A	Unknown	15 Tons	Serves WELAH2, but may soon be eliminated and chilled water used instead.

- **1 Steam to HW Converter**
- **2 HW Pumps (both constant volume)**
- **HW Fin Tube Radiation**
- **2 CHW Pumps (both variable volume, one serves Lommen Hall)**

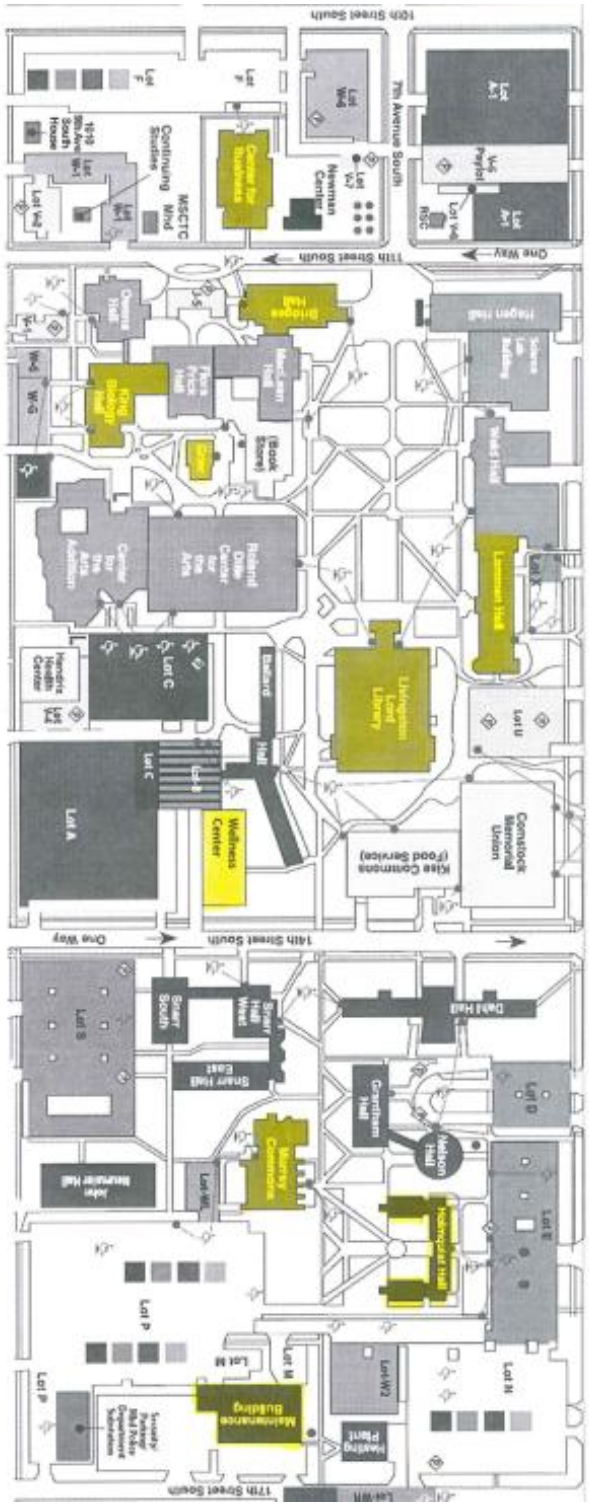
Points on BAS

- **WELAH1 Points:** RA RH, RAT, OA/MA damper position, MAT, SF status, Cooling valve, Heating valve, Cold deck temp, Hot deck temp, Space temp
- **WELAH2 Points:** RA RH, RAT, OA/MA damper position, MAT, SF status, DX stage, Heating valve, Cold deck temp, Hot deck temp, Space temp
- **WELAH3 Points:** RA RH, RAT, OA/MA damper position, MAT, Face/Bypass damper position, Heating valve, SF status, DAT, Space temp
- **Heating System Points:** HW valve, HWST, Pump status

Comments

- This building gets steam from the Heating Plant and gets chilled water from the Hagen Hall/Science Lab chiller.
- This building houses office space, classrooms, and an auditorium.
- The equipment in this building is on the Honeywell BAS.

Campus Map



NOTE: Buildings highlighted yellow are recommended for Investigation. The entire campus is not shown here due to space restraints.

PBEEEP Abbreviation Descriptions			
AHU	Air Handling Unit	hp	Horsepower
BAS	Building Automation System	HRU	Heat Recovery Unit
CD	Cold Deck	HW	Hot Water
CDW	Condenser Water	HWDP	Hot Water Differential Pressure
CDWRT	Condenser Water Return Temperature	HWP	Hot Water Pump
CDWST	Condenser Water Supply Temperature	HWRT	Hot Water Return Temperature
cfm	Cubic Feet per Minute	HWST	Hot Water Supply Temperature
CHW	Chilled Water	HX	Heat Exchanger
CHWRT	Chilled Water Return Temperature	kW	Kilowatt
CHWDP	Chilled Water Differential Pressure	kWh	Kilowatt-hour
CHWP	Chilled Water Pump	MA	Mixed Air
CHWST	Chilled Water Supply Temperature	MA Enth	Mixed Air Enthalpy
CRAC	Computer Room Air Conditioner	MARH	Mixed Air Relative Humidity
CV	Constant Volume	MAT	Mixed Air Temperature
DA	Discharge Air	MAU	Make-up Air Unit
DA Enth	Discharge Air Enthalpy	OA	Outside Air
DARH	Discharge Air Relative Humidity	OA Enth	Outside Air Enthalpy
DAT	Discharge Air Temperature	OARH	Outside Air Relative Humidity
DDC	Direct Digital Control	OAT	Outside Air Temperature
DP	Differential Pressure	Occ	Occupied
DSP	Duct Static Pressure	PTAC	Packaged Terminal Air Conditioner
DX	Direct Expansion	RA	Return Air
EA	Exhaust Air	RA Enth	Return Air Enthalpy
EAT	Exhaust Air Temperature	RARH	Return Air Relative Humidity
Econ	Economizer	RAT	Return Air Temperature
EF	Exhaust Fan	RF	Return Fan
Enth	Enthalpy	RH	Relative Humidity
ERU	Energy Recovery Unit	RTU	Rooftop Unit
FCU	Fan Coil Unit	SF	Supply Fan
FPVAV	Fan Powered VAV	Unocc	Unoccupied
FTR	Fin Tube Radiation	VAV	Variable Air Volume
GPM	Gallons per Minute	VFD	Variable Frequency Drive
HD	Hot Deck	VIGV	Variable Inlet Guide Vanes

Conversions
1 kWh = 3.412 kBtu
1 Therm = 100 kBtu
1 kBtu/hr = 1 MBH